TABLES

Table 1
Summary of Chemicals of Concern and
Medium-Specific Exposure Point Concentrations

Exposure Point	Chemical of Concern	Maximum Concentration Detected	Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
Source Area Plume	Benzene	3.2	ug/L	4 / 32	3.2	ug/L	MAX
	1,1-Dichloroethylene	0.66	ug/L	1 / 32	0.66	ug/L	MAX
	cis-1,2-Dichloroethylene	210	ug/L	4 / 14	210	ug/L	MAX
	1,2-Dichloropropane	39	ug/L	5 / 32	39	ug/L	MAX
	Iron	2,860	ug/L	3 / 19	2860	ug/L	MAX
	Manganese	183	ug/L	11 / 17	183	ug/L	MAX
	Nitrate	3,300	ug/L	17 / 17	3,300	ug/L	MAX
	Tetrachloroethylene	10,000	ug/L	18 / 32	10,000	ug/L	MAX
	Trichloroethylene	69	ug/L	9 / 32	69	ug/L	MAX
	Vinyl chloride	13	ug/L	1 / 32	13	ug/L	MAX
Southwest Plume	Benzene	2.1	ug/L	1 / 18	2.1	ug/L	MAX
	1,2-Dichloroethane	2.5	ug/L	1 / 18	2.5	ug/L	MAX
	cis-1,2-Dichloroethylene	17	ug/L	1 / 7	17	ug/L	MAX
	Iron	3,270	ug/L	4 / 10	3,270	ug/L	MAX
	Lead	4.5	ug/L	1 / 2	4.5	ug/L	MAX
	Manganese	1,000	ug/L	7 / 10	1,000	ug/L	MAX
	Nitrate	7,900	ug/L	10 / 10	7,900	ug/L	MAX
	Tetrachloroethylene	900	ug/L	6 / 18	900	ug/L	MAX
	Trichloroethylene	1.1	ug/L	3 / 18	1.1	ug/L	MAX
North Plume	Iron	396	ug/L	1 / 8	396	ug/L	MAX
	Manganese	1,240	ug/L	6 / 8	1,240	ug/L	MAX
	Nitrate	2,600	ug/L	8 / 9	2,600	ug/L	MAX
	Tetrachloroethylene	100	ug/L	7 / 17	100	ug/L	MAX
	Trichloroethylene	12	ug/L	3 / 17	12	ug/L	MAX

Key
ug/L: micrograms per liter
MAX: maximum detected concentration

This table presents chemicals of concern (COCs) and exposure point concentrations (EPCs) for all COCs in groundwater (i.e., the concentation that is used to estimate the exposure and risk from each COC in groundwater). Chemicals predicted to pose a cancer risk in excess of 1×10^{-6} or a hazard index in excess of 1 are designated as COCs. Additional rationale for including chemicals that do not pose significant risks as COCs is provided in the ROD text. Although the plume is no longer subdivided, data for the three parts of the plume are presented separately in this table, in order to be consistent with the presentation in the HLA risk assessment presented in the Remedial Investigation.

Table 2
Cancer Toxicity Data Summary

Chemical of Concern	Oral Cancer Slope Factor	Slope Factor Units	Weight of Evidence/Cancer Guideline Description	Source	Date
Arsenic	1.5E+00	$(mg/kg/day)^{-1}$	A	IRIS (a)	1998
Benzene	2.9E-02	$(mg/kg/day)^{-1}$	A	IRIS (b)	1988
1,2-Dichloroethane	9.1E-02	$(mg/kg/day)^{-1}$	B2	IRIS	1991
1,1-Dichloroethylene	--	--	not assessed (c)	IRIS	1989
cis-1,2-Dichloroethylene	--	--	D	IRIS	1995
1,2-Dichloropropane	6.8E-02	$(mg/kg/day)^{-1}$	B2	HEAST	1997
Iron	--	--	not assessed	--	--
Lead	--	--	B2	IRIS (a)	1993
Manganese	--	--	D	IRIS	1996
Methylene chloride	7.5E-03	$(mg/kg/day)^{-1}$	B2	IRIS	1995
Nitrate	--	--	not assessed	IRIS	1997
Tetrachloroethylene	5.2E-02	$(mg/kg/day)^{-1}$	B2	NCEA (d)	1992
Trichloroethylene	1.1E-02	$(mg/kg/day)^{-1}$	B2	HEAST (d)	1992
Vinyl chloride	1.90E+00	$(mg/kg/day)^{-1}$	A	HEAST (e)	2000

Key
--: No information available
IRIS: Integrated Risk Information Service, USEPA
HEAST: Health Effects Assessment Summary Tables, USEPA
NCEA: National Center for Environmental Assessment, USEPA
$(mg/kg/day)^{-1}$: per milligrams per kilogram body weight per day

EPA Group:
A - Human carcinogen
B1 - Probable human carcinogen, limited human data available
B2 - Probable human carcinogen, sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - No classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

a. No toxicity values for these chemicals are presented in the HLA risk assessment, because they were not designated as chemicals of potential concern.
b. IRIS revised the cancer toxicity value for benzene in 2000, such that the updated value is more stringent than that used in the HLA risk assessment.
c. IRIS classified 1,1-dichloroethylene as a class C carcinogen in 2002. No toxicity values were designated at that time.
d. Cancer toxicity values are under review by EPA; proposed values are more stringent than those used in the HLA risk assessment.
e. IRIS revised the cancer toxicity value for vinyl chloride in 2000, such that the updated value is less stringent than that used in the HLA risk assessment.

This table provides carcinogenic information that is relevant to the chemicals of concern (COCs) in groundwater and that were applied in the HLA risk assessment. As noted in the footnotes, several toxicity values have since been updated. Dermal values are not presented because dermal routes of exposure are not significant. Because inhalation risks were calculated as a function of ingestion risks, rather than based on inhalation toxicity information, inhalation values are not presented in this table.

Table 3
Noncancer Toxicity Data Summary

Chemical of Concern	Chronic/ Subchronic	Oral Reference Dose Value	Oral Reference Dose Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of Reference Dose, Target Organ	Date of Reference Dose, Target Organ
Arsenic	Chronic	3E-04	mg/kg/day	skin	3	IRIS (a)	1993
Benzene	Chronic	3.0E-03	mg/kg/day	--	--	NCEA (b)	--
1,2-Dichloroethane	Chronic	3.0E-02	mg/kg/day	--	--	NCEA	--
1,1-Dichloroethylene	Chronic	9.0E-03	mg/kg/day	liver	1,000	IRIS (b)	1987
cis-1,2-Dichloroethylene	Chronic	1E-02	mg/kg/day	blood	3,000	HEAST (b)	1997
1,2-Dichloropropane	--	--	--	--	--	--	--
Iron	--	--	--	--	--	(c)	--
Lead	--	--	--	--	--	IRIS (a)	1991
Manganese	Chronic	2.4E-02	mg/kg/day	CNS	1	IRIS (b)	1996
Methylene chloride	Chronic	6.0E-02	mg/kg/day	liver	100	IRIS	1988
Nitrate (d)	Chronic	1E-01	mg/kg/day	blood	10	IRIS	1997
Tetrachloroethylene	Chronic	1E-02	mg/kg/day	liver	1,000	IRIS (e)	1988
Trichloroethylene	Chronic	6E-03	mg/kg/day	--	--	NCEA (e)	--
Vinyl chloride	--	--	--	--	--	(f)	--

Key
mg/kg/day: milligrams per kilogram body weight per day
--: No information available
IRIS: Integrated Risk Information Service, USEPA
HEAST: Health Effects Assessment Summary Tables, USEPA
NCEA: National Center for Environmental Assessment, USEPA
CNS: central nervous system
a. No toxicity information for these chemicals is presented in the HLA risk assessment, because they were not designated as chemicals of potential concern.
b. IRIS revised the noncancer toxicity value for these chemicals, such that the updated values are less stringent than those used in the HLA risk assessment.
c. NCEA has issued a noncancer toxicity value for iron, such that noncancer hazards can now be quantified for this chemical.
d. Information presented for nitrate reflects the assumptions made in the HLA risk assessment; i.e., that all nitrogen present is nitrite. Therefore, the toxicity information for nitrite is shown here. Subsequent sampling demonstrated that all nitrogen present is in fact nitrate, which is less toxic than nitrite.
e. The noncancer toxicity values for these chemicals are under review by EPA; proposed values are more stringent thant those used in the HLA risk assessment.
f. IRIS issued noncancer toxicity values for vinyl chloride in 2000, such that noncancer hazards can now be quantified for this chemical.

This table provides noncarcinogenic toxicity information that is relevant to the chemicals of concern (COCs) in groundwaterand that were applied in the HLA risk assessment presented in the Remedial Investigation. As noted in the footnotes, several toxicity values have since been updated. Dermal values are not presented because dermal routes of exposure are not significant and slope factors are not available for the dermal route of exposure. Because inhalation risks were calculated as a function of ingestion risks, rather than based on inhalation toxicity information, inhalation values are not presented in this table.

Table 4
Summary of RME Cancer and Noncancer Risks

RECEPTOR	LOCATION	EXPOSURE PATHWAY	CANCER RISK (a) (RME)	HAZARD INDEX (RME)	
				Child	Adult
Future Commercial/ Industrial Worker	Source Area	Ingestion of potable groundwater	2E-03	N/A	4
		Inhalation of vapors migrating to indoor air	7E-05	N/A	0.09
		Inhalation of vapors from groundwater used as process water	4E-04	N/A	0.8
		TOTAL	**2E-03**	**N/A**	**5**
	North Plume	Ingestion of potable groundwater	2E-05	N/A	0.3
		Inhalation of vapors from groundwater used as process water	4E-06	N/A	0.004
		TOTAL	**2E-05**	**N/A**	**0.3**
	Southwest Plume	Ingestion of potable groundwater	2E-04	N/A	0.8
		Inhalation of vapors from groundwater used as process water	3E-05	N/A	0.05
		TOTAL	**2E-04**	**N/A**	**0.9**
Future Resident	Source Area	Ingestion of potable groundwater	1E-02	100	40
		Inhalation of vapors migrating to indoor air	7E-04	0.8	0.8
		Source Area, TOTAL Resident	**1E-02**	**100**	**40**
	North Plume	Ingestion of potable groundwater	1E-04	9	3
		North Plume, TOTAL Resident	**1E-04**	**9**	**3**
	Southwest Plume	Ingestion of potable groundwater	9E-04	20	7
		Dermal contact during swimming	3E-07	0.01	0.01
		Ingestion during swimming	1E-08	0.02	0.004
		Southwest Plume, TOTAL Resident	**9E-04**	**20**	**7**

a. The future resident cancer risk presented is the summation of the child and adult cancer risks.
N/A - Not Applicable.
Shading indicates where the total risk exceeds 1×10^{-4} or a Hazard Index of 1.
Bold numbers indicate subtotal or total values.

TABLE 5
Screening-Level Ecological Hazards Under No Action
AOC 50, Fort Devens

Analyte	HQs for Benthic Organisms		HQs for Pelagic Organisms	
	Average	Maximum	Average	Maximum
Metals				
Aluminum	0.6	1	0.002	0.005
Calcium	0.1	0.2	0.0005	0.0007
Iron	0.2	0.5	0.0009	0.002
Lead	1	2	0.006	0.007
Magnesium	0.02	0.02	0.00007	0.0001
Manganese [a]	0.9	3	0.004	0.01
Potassium	0.02	0.02	0.00007	0.0001
Sodium	0.004	0.005	0.00002	0.00002
Zinc	0.1	0.2	0.0005	0.0009
Screening-level Hazard Index [b]	3		0.01	
Volatile Organic Compounds				
1,2-Dichloroethene (cis- and trans-)	0.2	7	0.001	0.03
Chloromethane	0.000004	0.00003	0.00000002	0.0000001
1,2-Dichloropropane	0.01	0.02	0.00005	0.00008
Tetrachloroethene	0.9	4	0.004	0.02
Toluene	0.03	0.4	0.0001	0.002
Trichloroethene	0.01	0.3	0.00005	0.001
Screening-level Hazard Index [a]	1		0.005	

Notes:

HQ (hazard quotient) = exposure estimate / benchmark

Outlined values exceed HQ or Hazard Index of 1.

[a] Based on Michigan DEQ's Tier I value for manganese and assuming a hardness of 100 mg/L, average and maximum HQs for benthic organisms are 0.04 and 0.1, respectively.

[b] Hazard index = sum of chemical-specific HQs; Hazard indices not calculated for maximum exposure estimates because exposures to maximum concentrations of individual CPCs will not occur simultaneously; Hazard indices segregated for inorganic and organic CPCs due to differing mechanisms of action.

TABLE 6
Synopsis of Federal and State ARARs for Remedial Alternative 6
AOC 50, Devens, Massachusetts

ARAR TYPE	MEDIUM	REQUIREMENT	STATUS	SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal					
Chemical	Groundwater	Safe Drinking Water Act, National Primary Drinking Water Regulations, Maximum Contaminant Levels [40 CFR Parts 141.11 - 141.16 and 141.50 - 141.53]	Relevant and Appropriate	The National Primary Drinking Water Regulations (NPDWR) establish maximum contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) for several common organic and inorganic contaminants. MCLs specify the maximum permissible concentrations of contaminants in public drinking-water supplies. MCLs are federally enforceable standards based in part on the availability and cost of treatment techniques. MCLGs specify the maximum concentration at which no known or anticipated adverse effect on humans will occur. MCLGs are non-enforceable health-based goals that are always set equal to or lower than MCLs.	The MCLs for the chemicals of concern (COCs) will be met through active remediation of groundwater in selected areas of the plumes.
Chemical	Surface Water	Clean Water Act, Ambient Water Quality Criteria, 33 USC 1314, 40 CFR 131.36(b)(1), 63 Fed. Reg. 68359	To be considered	National recommended criteria for surface water quality establishes numerous criteria for constituents	Ambient water quality criteria were evaluated during the assessment of potential ecological risks and the development of preliminary remediation goals for AOC 50

TABLE 6
Synopsis of Federal and State ARARs for Remedial Alternative 6
AOC 50, Devens, Massachusetts

ARAR TYPE	MEDIUM	REQUIREMENT	STATUS	SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
State					
Chemical	Groundwater	Massachusetts Groundwater Quality Standards [314 CMR 6.00]	Applicable	Massachusetts Groundwater Quality Standards designate and assign uses for which groundwaters of the Commonwealth shall be maintained and protected and set forth water-quality criteria necessary to maintain the designated uses. Groundwater at Devens RFTA is classified GW-1. Groundwaters assigned to this class are fresh groundwaters designated as a source of potable water supply.	314 CMR 6.00 will be met by achieving MMCLs for COCs. The MMCLs for COCs will be met through active remediation of groundwater plume. Groundwater monitoring will be performed to measure changes in COC. State groundwater quality standards that are more stringent that Federal MCLs will be used as remediation goals.
Chemical	Groundwater	Massachusetts Drinking Water Standards and Guidelines [310 CMR 22.00]	Relevant and Appropriate	The Massachusetts Drinking Water Standards and Guidelines list Massachusetts Maximum Contaminant Level (MMCLs), which apply to water delivered to any user of a public water-supply system as defined in 310 CMR 22.00.	Devens groundwater is classified GW-1 and is designated as a source of potable water supply. State MCLs that are more stringent than Federal MCLs will be used as remediation goals.
State					
Chemical	Surface water	Massachusetts Surface Water Quality Standards [314 CMR 4.00]	Relevant and Appropriate	The Massachusetts Surface Water Quality Standards list Massachusetts surface water standards, which apply to discharge to the waters of the Commonwealth from any source. These standards: designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained and protected; prescribe the minimum water quality criteria required to sustain the designated uses; and contain regulations necessary to achieve the designated uses and maintain existing water quality.	Massachusetts Surface Water Quality Standards were considered during the assessment of acceptable risk levels and the development of preliminary remediation goals for AOC 50.

TABLE 6
Synopsis of Federal and State ARARs for Remedial Alternative 6
AOC 50, Devens, Massachusetts

ARAR TYPE	MEDIUM	REQUIREMENT	STATUS	SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal					
Location	Groundwater	Floodplain Management Executive Order No. 11988 [40 CFR Part 6, App. A]	Applicable, if remedial actions are performed within floodplain	Requires federal agencies to evaluate potential adverse effects associated with direct and indirect development of a floodplain. Alternatives that involve modification/ construction within a floodplain may not be selected unless a determination is made that no practicable alternative exists. If no practicable alternative exists, potential harm must be minimized and action taken to restore and preserve the natural and beneficial values of the floodplain.	Monitoring wells may be constructed in the floodplain. All construction in the floodplain will be conducted in a manner that minimizes harm and preserves and restores the natural and beneficial values of the floodplain. Appropriate federal agencies will be contacted and allowed to review the proposed work plan for the remedial action prior to implementation of the action.
Federal					
Location	Wetlands	Protection of Wetland Executive Order 11990 [40 CFR 6, Appendix A]	Applicable, if remedial actions are performed within wetlands	Requires federal agencies to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance natural and beneficial values of wetlands. If remediation is required within the wetland areas, and no practical alternative exists, potential harm must be minimized and action taken to restore natural and beneficial values.	Monitoring wells may be constructed in the wetlands. Construction will be performed in a manner that minimizes adverse effects on wetlands, to the extent practicable.
Location	Wetlands	Clean Water Act, Dredge or Fill Requirements Section 404 [33 CRF Part 230; 40 CRF Part 230]	Applicable if remedial actions are performed in U.S. water or within a floodplain	Section 404 of the CWA regulates the discharge of dredged or fill materials to U.S. waters, including wetlands. Filling wetlands would be considered a discharge of fill materials.	Any construction will be performed to minimize adverse effects on aquatic ecosystem.

TABLE 6
Synopsis of Federal and State ARARs for Remedial Alternative 6
AOC 50, Devens, Massachusetts

ARAR TYPE	MEDIUM	REQUIREMENT	STATUS	SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal (cont.)					
Location	Surface water, Endangered species, Migratory species	Fish and Wildlife Coordination Act [16 USC 661 et seq.; 40 CFR Part 302]	Applicable	Requires that the US Fish and Wildlife Service (USFWS) and National Marine Fisheries Service be consulted in the alteration of a body of water, such as if installation of monitoring wells in a wetland and/or discharge of pollutants into a wetland will occur as a result of off-site remedial activities. Requires consultation with state agencies to devise measures to prevent, mitigate, or compensate for project-related losses to fish and wildlife.	Construction will be performed in a manner that minimizes adverse effects on wildlife resources and habitat. Measures will be developed to prevent or mitigate project-related impacts to habitat and wildlife. The USFWS, acting as a review agency for the USEPA, will be kept informed of proposed remedial actions.
State					
Location	Groundwater	Massachusetts Wetland Protection Act [310 CMR 10.00]	Relevant and Appropriate	These regulations include standards on dredging, filling, altering, or polluting inland wetlands and protected areas (defined as area within the riverfront area or the 100-year floodplain). A Notice of Intent (NOI) must be filed with the municipal conservation commission and a Final Order of Conditions obtained before proceeding with the activity. A Determination of Applicability or NOI must be filed for activities such as excavation within a 100-foot buffer zone. The regulations specifically prohibit loss of over 5,000 square feet or bordering vegetated wetlands. Loss may be permitted with replication of any lost area within two growing seasons.	Any proposed remedial actions within riverfront area (defined as the river's mean annual high-water line measured horizontally outward from the river and a parallel line located 200 feet away), wetlands, or the 100-foot buffer will be developed and evaluated to minimize adverse effects on wetlands and to attain compliance with the substantive requirements of these regulations.

TABLE 6
Synopsis of Federal and State ARARs for Remedial Alternative 6
AOC 50, Devens, Massachusetts

ARAR TYPE	MEDIUM	REQUIREMENT	STATUS	SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal					
Action	Groundwater Injection	Safe Drinking Water Act (SDWA) Regulations, Underground Injection Control Program (40 CFR Parts 144, 146, 147, and 1000)	Relevant and Appropriate	These regulations outline minimum program and performance standards for underground injection programs.	The regulation applies and would be complied with because the alternative includes injection into the aquifer.
Action	Investigation derived waste	USEPA OSWER Publication 9345.303FS, January 1992	To be considered	Management of IDW must ensure protection of human health and the environment.	IDW produced from remedial activities will be managed in compliance with this guidance.
Federal					
Action	Hazardous Waste	RCRA Regulations. Identification and Listing of Hazardous Waste (40 CFR Part 261)	Applicable	Defines listed and characteristic hazardous wastes subject to RCRA. These regulations would apply when determining whether or not waste on site is hazardous either by being listed or exhibiting a hazardous characteristic as described in the regulations.	Groundwater treatment residues will be evaluated against the criteria and definitions of hazardous waste. The criteria and definition of hazardous waste refers to those wastes subject to regulations as hazardous wastes under 40 CFR parts 124 and 264. IDW produced during remedial activities will be managed in accordance with these regulations.
Action	Hazardous Waste	Standards Applicable to Generators of Hazardous Waste (RCRA 40 CFR 262)	Applicable	These regulations establish standards for generators of hazardous waste. RCRA Subtitle C established standards applicable to treatment, storage, and disposal of hazardous waste and closure of hazardous waste facilities.	Treatment residues will be tested to determine whether they contain characteristic hazardous waste. If so, management of the hazardous waste would comply with substantive requirements of these regulations.

TABLE 6
Synopsis of Federal and State ARARs for Remedial Alternative 6
AOC 50, Devens, Massachusetts

ARAR TYPE	MEDIUM	REQUIREMENT	STATUS	SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
State					
Action	Hazardous Waste	Massachusetts Hazardous Waste Management Rules; 310 CMR 30.000	Relevant and Appropriate	This requirement sets standards for generators of hazardous waste that address (1) accumulating waste, (2) preparing hazardous waste for shipment, and (3) preparing the uniform hazardous waste manifest. Massachusetts specifies requirements for very small quantity generators, as well as small and large quantity generators.	If RCRA-characteristic hazardous wastes are generated, the material will be managed in accordance with these requirements.

Notes:
ARARs = Applicable, Relevant and Appropriate Regulations
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Regulations
COC= Chemical of Concern
CWA = Clean Water Act
IDW = Investigation derived waste
MCL = Maximum Contaminant Level
MCLG = Maximum Contaminant Level Goal
MMCL = Massachusetts Maximum Contaminant Level
NOI = Notice of Intent
NPDWR = National Primary Drinking Water Regulations
NSDWR = National Secondary Drinking Water Regulations
OSWER = Office of Solid Waste and Emergency Response
RCRA = Resource Conservation and Recovery Act
RFTA=Reserves Forces Training Area
SDWA = Safe Drinking Water Act
SMCL = Secondary Maximum Contaminant Level
USEPA = U.S. Environmental Protection Agency

Table 7
Interim Groundwater Cleanup Levels

Carcinogenic Chemical of Concern (a)	Cancer Classification	Interim Cleanup Level (ug/L)	Basis	RME Risk (b)
Arsenic	A	10	MCL (c)	2.0E-04
Benzene	A	5	MCL	7.4E-06
1,2-Dichloroethane	B2	5	MCL	1.2E-05
Lead	B2	15	NIPDWR (d)	NC
Methylene chloride	B2	5	MCL	1.0E-06
Tetrachloroethylene	B2	5	MCL	7.0E-06
Trichloroethylene	B2	5	MCL	5.4E-05
Vinyl chloride	A	2	MCL	4.1E-05
Sum of Carcinogenic Risk				3E-04
Noncarcinogenic Chemicals of Concern (e)	**Target Endpoint**	**Interim Cleanup Level (ug/L)**	**Basis**	**RME Hazard Quotient (f)**
1,1-Dichloroethylene	liver	7	MCL	0.03
1,2-Dichloropropane	--	5	MCL	0.2
cis-1,2-Dichloroethylene	blood	70	MCL	1
Iron	--	3,129	Risk-based concentration (g)	1
Manganese	CNS	1,460	Risk-based concentration (g)	1
Nitrate	blood	10,000	MCL	0.6
Sum of Noncarcinogenic Hazard for Blood Target Endpoint				2

Key
--: no information available
CNS: central nervous system
NC: not calculated due to lack of toxicity data
ug/L: micrograms per liter
RME: reasonable maximum exposure
MCL: Maximum Contaminant Level

a. Includes all detected A, B, or C carcinogens that exceed an ARAR.
b. Risks are calculated for adult residential potable water ingestion and inhalation of volatile organic compounds, assuming exposure to concentrations at the interim cleanup levels. Inhalation risks assumed equal to ingestion risks, where Ingestion Cancer risk = CSF x [(ICL x CF x IR x EF x ED x (1/AT) x (1/BW)], where:
CSF = cancer slope factor (see Table 2, but using updated values where available) $(mg/kg\text{-}day)^{-1}$
ICL = interim cleanup level (as listed in present table) (ug/L)
CF = conversion factor (0.001 mg/ug)
IR = water ingestion rate (2.3 L/day)
EF = exposure frequency (350 day/year)
ED = exposure duration (30 years)
AT = averaging time (10,950 days)
BW = body weight (70 kg)
c. MCL of 10 ug/L for arsenic is not effective until 1/26/06; however, EPA has indicated that this is the maximum interim cleanup level likely to be accepted for arsenic.
d. NIPDWR is a National Interim Primary Drinking Water Regulation, and it is based on treatment technology. EPA has indicated that the NIPDWR is the maximum interim cleanup level likely to be accepted likely to be accepted for lead.
e. Includes all detected chemicals in groundwater that exceed an ARAR and are not A, B, or C carcinogens.
f. Hazards are calculated for child residential potable water ingestionand inhalation of volatile organic compounds, assuming exposure to concentrations at the interim cleanup levels. Inhalation hazards assumed equal to ingestion hazards, where Ingestion Noncancer Hazard = [ICL x CF x IR x EF x ED x (1/AT) x (BW)] / RfD, where,
IR = water ingestion rate (1.5 L/day)
ED = exposure duration (6 years)
BW = body weight (15 kg)
RfD = reference dose (see Table 3, but using updated values where available) (mg/kg-day)
AT = averaging time (2,190 days)
and all other inputs as listed above under footnote b
g. Risk-based concentrations derived in Table 8

Table 8
Derivation of Risk-Based Concentrations for Manganese and Iron Based on Child Residents

Parameter Code	Parameter Definition	Units	Value
HI	Target Hazard Index	unitless	1
IR	Ingestion Rate	L/day	1.5
EF	Exposure Frequency	days/year	350
ED	Exposure Duration	years	6
Ao	Oral Absorption	unitless	1.0
BW	Body Weight	kg	15
ATnc	Averaging Time (noncancer)	days	2,190
RfD - Fe	Reference Dose - Iron	mg/kg-day	3.0E-01
RfD - Mn	Reference Dose - manganese	mg/kg-day	1.4E-01
RBC - Fe	**Risk-based Concentration - Iron**	**ug/L**	**3,129**
RBC - Mn	**Risk-based Concentration - Manganese**	**ug/L**	**1,460**

a. RBC = 1000 x HI x BW x ATnc x RfD x 1/IR x 1/EF x 1/ED x 1/Ao

Table 9
Interim Porewater Cleanup Levels

Ecological Chemical of Concern (a)	Interim Cleanup Level (ug/L)	Basis	Maximum Hazard Quotient (b)
cis-1,2-Dichloroethylene	31.2	Tier II SCV	7
Lead	2.5	AWQC at hardness of 100 mg/L	2
Manganese	1,930	FCV at hardness of 100 mg/L	3
Tetrachloroethylene	125	Tier II SCV	4

Key
ug/L: micrograms per liter
AWQC: chronic freshwater Ambient Water Quality Criteria (USEPA 2002)
FCV: Final Chronic Value (MDEQ 2002)
Tier II SCV: Tier II Secondary Chronic Value (Suter 1996)

a. Includes all detected chemicals in groundwater for which hazard quotients calculated for benthic organisms from maximum concentrations exceed 1.

b. Based on direct contact of benthic organisms with maximum detected concentrations in groundwater (as a surrogate for porewater).

Table 10. Comparison of Remedial Alternatives

Evaluation Criteria	Alt. 1: No Action	Alt. 2: SVE, MNA, IC	Alt. 3: SVE, P&T, Monitoring, IC	Alt. 4: SVE, IWS, Monitoring, IC	Alt. 5: SVE, ERD, Monitoring, IC	Alt. 6: SVE, ERD, IWS, Monitoring, IC	Alt. 7: SVE, ERD, IWS, ZVI, Monitoring, IC	Alt. 8: SVE, IWS, CHEMOX, Monitoring, IC	Alt. 9: SVE, ERD, P&T, Monitoring, IC
Protects Human Health and Environment	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Meets Federal and State Requirements (ARARs)	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Long-term Protection (effectiveness)	○	○	◑	◑	◑	●	●	◑	●
Reduces Mobility, Toxicity, or Volume	○	○	◑	◑	◑	◑	◑	◑	◑
Short-term Protection (effectiveness)	○	○	●	◑	○	●	●	◑	●
Relative Ease of Implementation	●	●	◑	◑	●	◑	○	◑	◑
Cost	$0	$4,200,000	$9,600,000	$10,700,000	$5,700,000	$8,200,000	$7,800,000	$11,100,000	$10,500,000
State Agency Acceptance	The state letter of concurrence is provided in Appendix B.								
Community Acceptance	The community comments are in the Responsiveness Summary (Appendix C).								

○ Low ◑ Moderate ● High * Preferred Alternative

TABLE 11
Comparative Analysis of Cost
AOC 50, Devens, Massachusetts

REMEDIAL ALTERNATIVE	DESCRIPTION	INITIAL CAPITAL COST ($)	AVERAGE ANNUAL O&M COST ($)	ESTIMATED RESTORATION TIME (YEARS)	PRESENT VALUE AT PRESCRIBED DISCOUNT RATE
1	No Action	$ -	$ -	48	$ -
2	Soil Vapor Extraction, Monitored Natural Attenuation, Institutional Controls	$ 330,000	$ 160,000	48	$ 4,200,000
3	Soil Vapor Extraction, Groundwater Extraction, Ex-Situ Treatment by Air Stripping and Carbon Adsoprtion, Surface Water Discharge, Monitoring, Institutional Controls	$ 2,000,000	$ 460,000	25	$ 9,600,000
4	Soil Vapor Extraction, In-Well Stripping, Monitoring, Institutional Controls	$ 2,500,000	$ 450,000	30	$ 10,700,000
5	Soil Vapor Extraction, Enhanced Reductive Dechlorination, Monitoring, Institutional Controls	$ 1,100,000	$ 260,000	26	$ 5,700,000
6	Soil Vapor Extraction, Enhanced Reductive Dechlorination, In-Well Stripping/Aerobic Bioremediation, Monitoring, Institutional Controls	$ 1,700,000	$ 370,000	27	$ 8,200,000
7	Soil Vapor Extraction, Enhanced Reductive Dechlorination, Zero-Valent Iron, In-Well Stripping/Aerobic Bioremediation, Monitoring, Institutional Controls	$ 1,700,000	$ 380,000	23	$ 7,800,000
8	Soil Vapor Extraction, Chemical Oxidation, In-Well Stripping, Monitoring, Institutional Controls	$ 2,600,000	$ 470,000	29	$ 11,100,000
9	Soil Vapor Extraction, Enhanced Reductive Dechlorination, Groundwater Extraction, Ex-Situ Treatment by Air Stripping and Carbon Adsoprtion, Surface Water Discharge, Monitoring, Institutional Controls	$ 1,800,000	$ 540,000	24	$ 10,500,000

TABLE 12
Detailed Cost Backup - Alternative 6
Soil Vapor Extraction, Enhanced Reductive Dechlorination, In-Well Stripping/Aerobic Bioremediation, Groundwater Monitoring, Institutional Controls
AOC 50, Fort Devens

Description	Unit	Unit Cost	Source	Estimated Quantity	Estimated Cost
Capital Costs					
Pre-Design Investigation					
Investigation work plan preparation (percentage of investigation costs)	%	$ 328	a	15	$ 4,913
Investigation activities					
Mobilization (equipment, decon pad construction)	Lump Sum	$ 5,000	b	1	$ 5,000
Drilling subcontractor (Rig, Tender, and Crew)	Days	$ 1,800	b	5	$ 9,000
Field supplies (rental equipment, sampling supplies, decon supplies)	Lump Sum	$ 2,500	a	1	$ 2,500
IDW disposal (including drums and transportation, assumes non-haz profile)	Drum	$ 150	c	4	$ 600
Field oversight, data reduction	Hour	$ 95	d	70	$ 6,650
Laboratory analyses					
VOCs - groundwater	Each	$ 150	e	16	$ 2,400
Metals - groundwater	Each	$ 100	e	16	$ 1,600
Miscellaneous (grain size analysis, TOC, etc.)	Lump Sum	$ 5,000	f	1	$ 5,000
Circulation well/IWS pilot test	Lump Sum	$ 50,000	a	1	$ 50,000
				Subtotal:	$ 87,663
Monitoring Well, Injection Well, Circulation Well, and SVE Well Installation					
Well installation activities					
Mobilization (equipment, decon pad construction)	Lump Sum	$ 8,000	b	1	$ 8,000
Monitoring well installation (drilling equipment, crew, materials)	Well	$ 7,000	b	5	$ 35,000
Injection well installation (drilling equipment, crew, materials)	Well	$ 7,000	b	40	$ 280,000
SVE well installation (drilling equipment, crew, materials)	Well	$ 3,500	b	3	$ 10,500
Circulation well installation (includes packers and inner casing)	Well	$ 15,500	b	4	$ 62,000
PID	Week	$ 300	g	10	$ 3,000
Field expenses	Day	$ 200	a	50	$ 10,000
Drill Cuttings Disposal (transport, treatment & disposal, assumes non-haz profile)	Ton	$ 90	a	130	$ 11,700
Development Water Disposal (off-site treatment)	Gallon	$0.85	a	5300	$ 4,505
Field oversight, data reduction	Hour	$ 95	d	640	$ 60,800
				Subtotal:	$ 485,505
SVE System Refurbishment					
Allowance for equipment repair/replacement	Lump Sum	$ 20,000	a	1	$ 20,000
				Subtotal:	$ 20,000
Injection System Setup					
Equipment building construction	Lump Sum	$ 25,000	a	1	$ 25,000
Injection well fit-out					
Wellhead assembly	Each	$ 500	a	40	$ 20,000
Batch injection equipment					
Tank truck and pump	Each	$ 25,000	a	1	$ 25,000
Molasses mixing system	Lump Sum	$ 15,000	a	1	$ 15,000
Hoses, fittings, and gauges	Lump Sum	$ 8,000	a	1	$ 8,000
System setup oversight and injection test run	%	$ 930	a	15	$ 13,950
				Subtotal:	$ 106,950
IWS System Installation					
Equipment shed construction	Lump Sum	$ 20,000	a	1	$ 20,000
Circulation well fit-out					
Vaults (installed)	Each	$ 2,500	a	4	$ 10,000
Drop-tubes, fittings, and gauges	Each	$ 1,000	a	4	$ 4,000
Underground utilities and piping					
Electric service drop and transformer installation	Lump Sum	$ 2,500	a	1	$ 2,500
Trenching	Linear Foot	$ 10	a	1,000	$ 10,000
Installation of power cable and conduit to shed	Linear Foot	$ 15	a	500	$ 7,500
Installation of compressed air hose to circulation wells	Linear Foot	$ 6	a	4,000	$ 24,000
Installation of vapor collection piping (2" Schedule 40 PVC)	Linear Foot	$ 10	a	4,000	$ 40,000
Trenching restoration	Lump Sum	$ 5,000	a	1	$ 5,000
Equipment					
Compressor	Each	$ 7,000	a	1	$ 7,000
Regenerative blower and vapor collection skid	Each	$ 5,000	a	1	$ 5,000
Vapor-phase carbon adsorbers	Each	$ 7,000	l	2	$ 14,000
System controls and telemetry	Lump Sum	$ 20,000	a	1	$ 20,000
Installation oversight, system shakedown and startup	%	$ 1,690	a	10	$ 16,900
				Subtotal:	$ 185,900
Baseline Groundwater Sampling Event					
Low-flow groundwater sampling activities (35 monitoring wells)					
Submersible pump w/ control box (3)	Week	$ 1,200	g	1	$ 1,200
Horiba U-22 with flow-through cell (3)	Week	$ 1,200	g	1	$ 1,200
Dedicated tubing	Linear Foot	$ 3	g	1,500	$ 4,500
Generator (3)	Week	$ 500	g	1	$ 500
Electronic water level indicator (2)	Week	$ 200	g	1	$ 200
PID (3)	Week	$ 900	g	1	$ 900
Truck rental (3)	Week	$ 1,200	a	1	$ 1,200
Field supplies (H&S, decon, sampling)	Lump Sum	$ 1,000	a	1	$ 1,000
Field labor, data reduction	Hour	$ 95	d	240	$ 22,800

TABLE 12
Detailed Cost Backup - Alternative 6
Soil Vapor Extraction, Enhanced Reductive Dechlorination, In-Well Stripping/Aerobic Bioremediation, Groundwater Monitoring, Institutional Controls
AOC 50, Fort Devens

Description	Unit	Unit Cost	Source	Estimated Quantity	Estimated Cost
Laboratory analyses					
VOCs	Each	$ 150	e	40	$ 6,000
Dissolved metals (arsenic, iron, manganese)	Each	$ 120	e,h	40	$ 4,800
Nitrate	Each	$ 20	h	40	$ 800
Nitrite	Each	$ 20	h	40	$ 800
Sulfate	Each	$ 20	h	40	$ 800
Sulfide	Each	$ 40	h	40	$ 1,600
Dissolved gases (carbon dioxide, methane, ethane, ethene)	Each	$ 125	h	40	$ 5,000
Reporting	Lump Sum	$ 20,000	a	1	$ 20,000
				Subtotal:	$ 73,300
Subtotal					*$ 959,318*
Contingency (10% scope + 15% bid)			j		*$ 239,829*
Revised Subtotal					*$ 1,199,147*
Technical Services					
Permitting (substantive requirements)	%	$ 11,991	a	1	$ 11,991
Institutional controls					
Coordination with off-site property owners		$ 40,000	a	1	$ 40,000
Develop Institutional Control Compliance Plan		$ 5,000	a	1	$ 5,000
Record groundwater use restrictions		$ 5,000	a	1	$ 5,000
Develop site information database		$ 10,000	a	1	$ 10,000
Project management (percentage of revised subtotal, direct capital costs)	%	$ 11,991	k	8	$ 95,932
Remedial design (percentage of revised subtotal, direct capital costs)	%	$ 11,991	k	15	$ 179,872
Construction management (percentage of revised subtotal, direct capital costs)	%	$ 11,991	k	10	$ 119,915
				Subtotal:	$ 467,710
Total Capital Costs (undiscounted)					$ 1,666,857
O&M Costs, Years 1-2					
Annual costs					
Quarterly groundwater sampling, identical in scope to baseline event	Each	$ 73,300	--	4	$ 293,200
Institutional control compliance inspection	Each	$ 5,000	a	1	$ 5,000
Injections (monthly)					
Molasses	250-gal tote	$ 750	a	23	$ 17,250
Electric	KWh	$ 0.20	a	43,800	$ 8,760
Potable water (injections)	Gallon	$ 0.05	a	55,000	$ 2,750
Labor associated with injections	Event	$ 4,000	d	12	$ 48,000
Batch system maintenance					
Equipment repairs/maintenance	Lump Sum	$ 5,000	a	1	$ 5,000
Labor associated with system O&M	Hour	$ 95	d	240	$ 22,800
IWS system O&M costs					
Emissions monitoring	Month	$ 250	m	12	$ 3,000
Treatment efficiency monitoring	Year	$ 500	e,h	1	$ 500
Electric	KWh	$ 0.20	a	131,400	$ 26,280
Carbon replacement/recycling	Pound	$ 3.00	l	12,000	$ 36,000
Equipment repairs	Lump Sum	$ 5,000	a	1	$ 5,000
Labor associated with system O&M	Hour	$ 95	d	240	$ 22,800
SVE System O&M costs					
Emissions monitoring	Month	$ 500	m	12	$ 6,000
Electric	KWh	$ 0.20	a	61,320	$ 12,264
Carbon replacement/recycling	Pound	$ 3.00	l	16,000	$ 48,000
Equipment repairs	Lump Sum	$ 5,000	a	1	$ 5,000
Labor associated with system O&M	Hour	$ 95	d	360	$ 34,200
				Subtotal:	$ 601,804
Subtotal					*$ 601,804*
Contingency (10% scope + 15% bid)			j		*$ 150,451*
Revised Subtotal					*$ 752,255*
Technical Services					
Project management (percentage of revised subtotal, direct annual O&M costs)	%	$ 7,523	k	10	$ 75,226
Technical support (percentage of revised subtotal, direct annual O&M costs)	%	$ 7,523	k	15	$ 112,838
				Subtotal:	$ 188,064
Annual O&M Costs, Years 1-2					*$ 940,319*
Periodic costs					
None	--	$ -	--	0	$ -
Total O&M Costs, Years 1-2 (undiscounted)					$ 1,880,638
O&M Costs, Years 3-27					
Annual costs					
Annual groundwater sampling, identical in scope to baseline event	Each	$ 73,300	--	1	$ 73,300

TABLE 12
Detailed Cost Backup - Alternative 6
Soil Vapor Extraction, Enhanced Reductive Dechlorination, In-Well Stripping/Aerobic Bioremediation, Groundwater Monitoring, Institutional Controls
AOC 50, Fort Devens

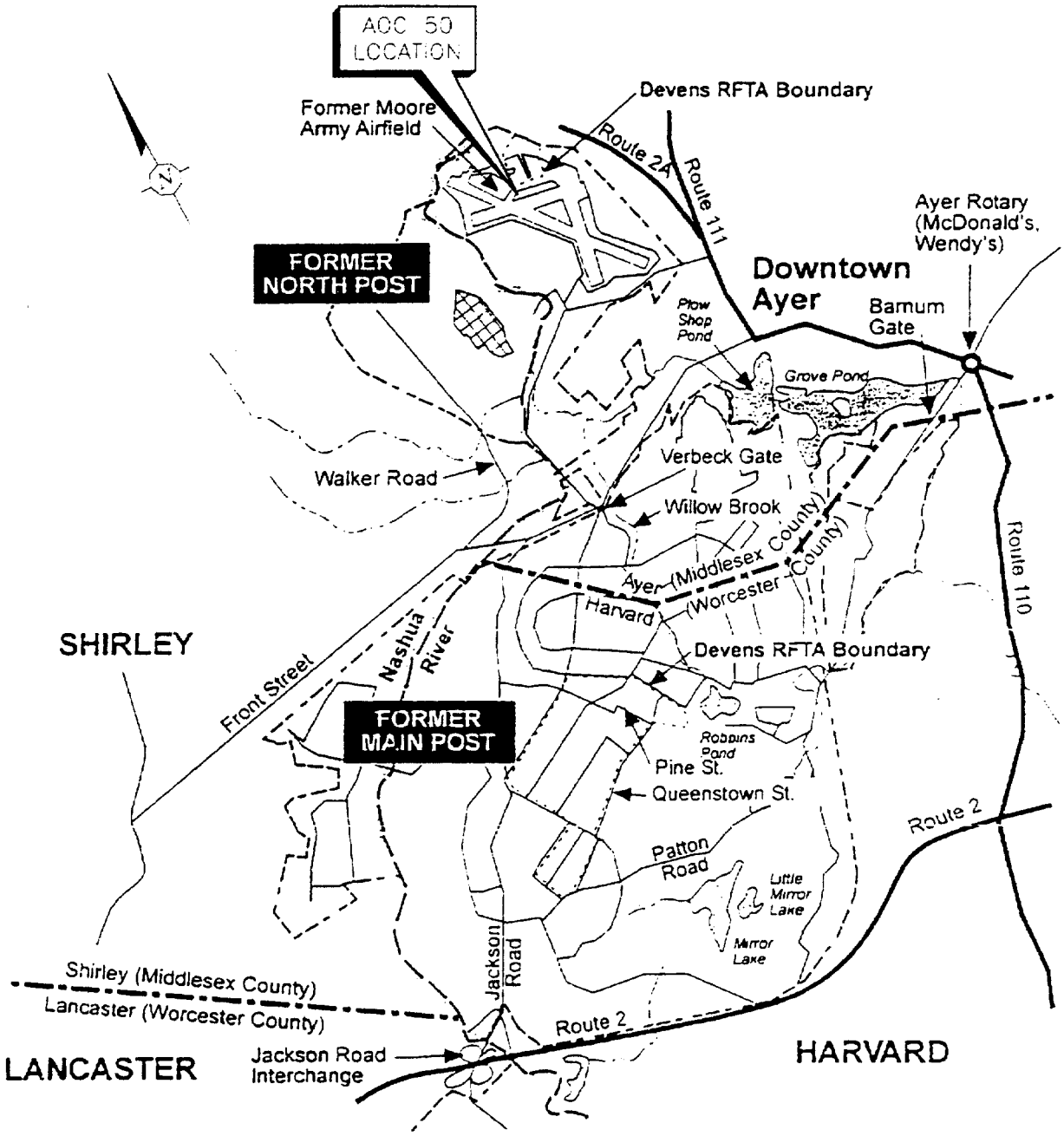
Description	Unit	Unit Cost	Source	Estimated Quantity	Estimated Cost
Institutional control compliance inspection	Each	$ 5,000	a	1	$ 5,000
Injections (quarterly)					
Molasses	250-gal tote	$ 750	a	8	$ 5,750
Electric	KWh	$ 0.20	a	14,600	$ 2,920
Potable water (injections)	Gallon	$ 0.05	a	18,333	$ 917
Labor associated with injections	Event	$ 4,000	d	4	$ 16,000
Batch system maintenance					
Equipment repairs/maintenance	Lump Sum	$ 5,000	a	1	$ 5,000
Labor associated with system O&M	Hour	$ 95	d	120	$ 11,400
IWS system O&M costs					
Emissions monitoring	Month	$ 250	m	12	$ 3,000
Treatment efficiency monitoring	Year	$ 500	e,h	1	$ 500
Electric	KWh	$ 0.20	a	131,400	$ 26,280
Carbon replacement/recycling	Pound	$ 3.00	l	4,000	$ 12,000
Equipment repairs	Lump Sum	$ 5,000	a	1	$ 5,000
Labor associated with system O&M	Hour	$ 95	d	240	$ 22,800
				Subtotal:	$ 189,867
Subtotal					$ *189,867*
Contingency (10% scope + 15% bid)			j		$ *47,467*
Revised Subtotal					$ *237,333*
Technical Services					
Project management (percentage of revised subtotal, direct annual O&M costs)	%	$ 2,373	k	10	$ 23,733
Technical support (percentage of revised subtotal, direct annual O&M costs)	%	$ 2,373	k	15	$ 35,600
				Subtotal:	$ 59,333
Annual O&M Costs, Years 3-27					$ *296,667*
Periodic costs					
SVE system O&M (year 3)	Lump Sum	$ 105,464	a	1	$ 105,464
SVE system decommisioning (year 4)	Lump Sum	$ 25,000	a	1	$ 25,000
Five-year site reviews (years 5, 10, 15, 20, and 25)	Each	$ 25,000	a	1	$ 25,000
Circulation well repair/rebuild (years 5, 10, 15, 20, and 25)	Each	$ 1,200	a	4	$ 4,800
Monitoring, injection, and SVE well abandonment (year 23)	Each	$ 1,000	b	258	$ 258,000
Circulation well abandonment (year 27)	Each	$ 2,000	b	4	$ 8,000
System decommissioning (year 27)	Lump Sum	$ 25,000	a	1	$ 25,000
Remedial Action Report (year 27)	Lump Sum	$ 20,000	a	1	$ 20,000
Total O&M Costs, Years 3-27 (undiscounted)					$ 8,007,131
Total Undiscounted Cost of Remedial Alternative					$11,554,625

Source Information:

- a Based on experience with similar projects
- b Based on quotes from Dragin Drilling Company of Wareham, Massacusetts
- c Based on quotes from General Chemical Corporation of Framingham Massachusetts
- d Typical labor rates for services described
- e Based on quotes from Amro Environmental Laboratories Corporation of Merrimack, New Hampshire
- f Allowance, based on expenence with similar projects
- g Based on quotes from Pine Environmental Services, Inc. of Woburn, Massachusetts
- h Based on quotes from Microseeps, Inc. (specialty lab) of Pittsburgh, Pennsylvania
- j Scope and bid contingencies estimated in accordance with Section 5.5 of the EPA Guide to Developing and Documenting Cost Estimates During the Feasibility Study (EPA 540-R-00-002)
- k Professional and technical services costs estimated in accordance with Section 5.5 of the EPA Guide to Developing and Documenting Cost Estimates During the Feasibility Study (EPA 540-R-00-002)
- l Based on quotes from US Filter Westates Carbon of Warren, New Jersey
- m Based on quotes from Vaportech Services, Inc. of Valencia, Pennsylvania

TABLE 13
Present Value Calculation for Remedial Alternative 6
Soil Vapor Extraction, Enhanced Reductive Dechlorination, In-Well Stripping/Aerobic Bioremediation, Groundwater Monitoring, Institutional Controls
AOC 50, Fort Devens

YEAR	CAPITAL COST ($)	O&M COST ($)	PERIODIC COST ($)	TOTAL UNDISCOUNTED COST ($)	DISCOUNT FACTOR AT 3.8%	TOTAL PRESENT VALUE ($)
0	$ 1,666,857	$ -	$ -	$ 1,666,857	1.000	$ 1,666,857
1	$ -	$ 940,319	$ -	$ 940,319	0.963	$ 905,895
2	$ -	$ 940,319	$ -	$ 940,319	0.928	$ 872,731
3	$ -	$ 296,667	$ 105,464	$ 402,131	0.894	$ 359,563
4	$ -	$ 296,667	$ 25,000	$ 321,667	0.861	$ 277,087
5	$ -	$ 296,667	$ 29,800	$ 326,467	0.830	$ 270,927
6	$ -	$ 296,667	$ -	$ 296,667	0.799	$ 237,184
7	$ -	$ 296,667	$ -	$ 296,667	0.770	$ 228,501
8	$ -	$ 296,667	$ -	$ 296,667	0.742	$ 220,135
9	$ -	$ 296,667	$ -	$ 296,667	0.715	$ 212,077
10	$ -	$ 296,667	$ 29,800	$ 326,467	0.689	$ 224,836
11	$ -	$ 296,667	$ -	$ 296,667	0.663	$ 196,833
12	$ -	$ 296,667	$ -	$ 296,667	0.639	$ 189,627
13	$ -	$ 296,667	$ -	$ 296,667	0.616	$ 182,685
14	$ -	$ 296,667	$ -	$ 296,667	0.593	$ 175,997
15	$ -	$ 296,667	$ 29,800	$ 326,467	0.572	$ 186,586
16	$ -	$ 296,667	$ -	$ 296,667	0.551	$ 163,347
17	$ -	$ 296,667	$ -	$ 296,667	0.530	$ 157,367
18	$ -	$ 296,667	$ -	$ 296,667	0.511	$ 151,606
19	$ -	$ 296,667	$ -	$ 296,667	0.492	$ 146,056
20	$ -	$ 296,667	$ 29,800	$ 326,467	0.474	$ 154,843
21	$ -	$ 296,667	$ -	$ 296,667	0.457	$ 135,558
22	$ -	$ 296,667	$ -	$ 296,667	0.440	$ 130,595
23	$ -	$ 296,667	$ -	$ 296,667	0.424	$ 125,814
24	$ -	$ 296,667	$ -	$ 296,667	0.409	$ 121,208
25	$ -	$ 296,667	$ 29,800	$ 326,467	0.394	$ 128,501
26	$ -	$ 296,667	$ -	$ 296,667	0.379	$ 112,496
27	$ -	$ 296,667	$ 311,000	$ 607,667	0.365	$ 221,992
Totals	$ 1,666,857	$ 9,297,304	$ 590,464	$ 11,554,625	--	$ 8,156,903



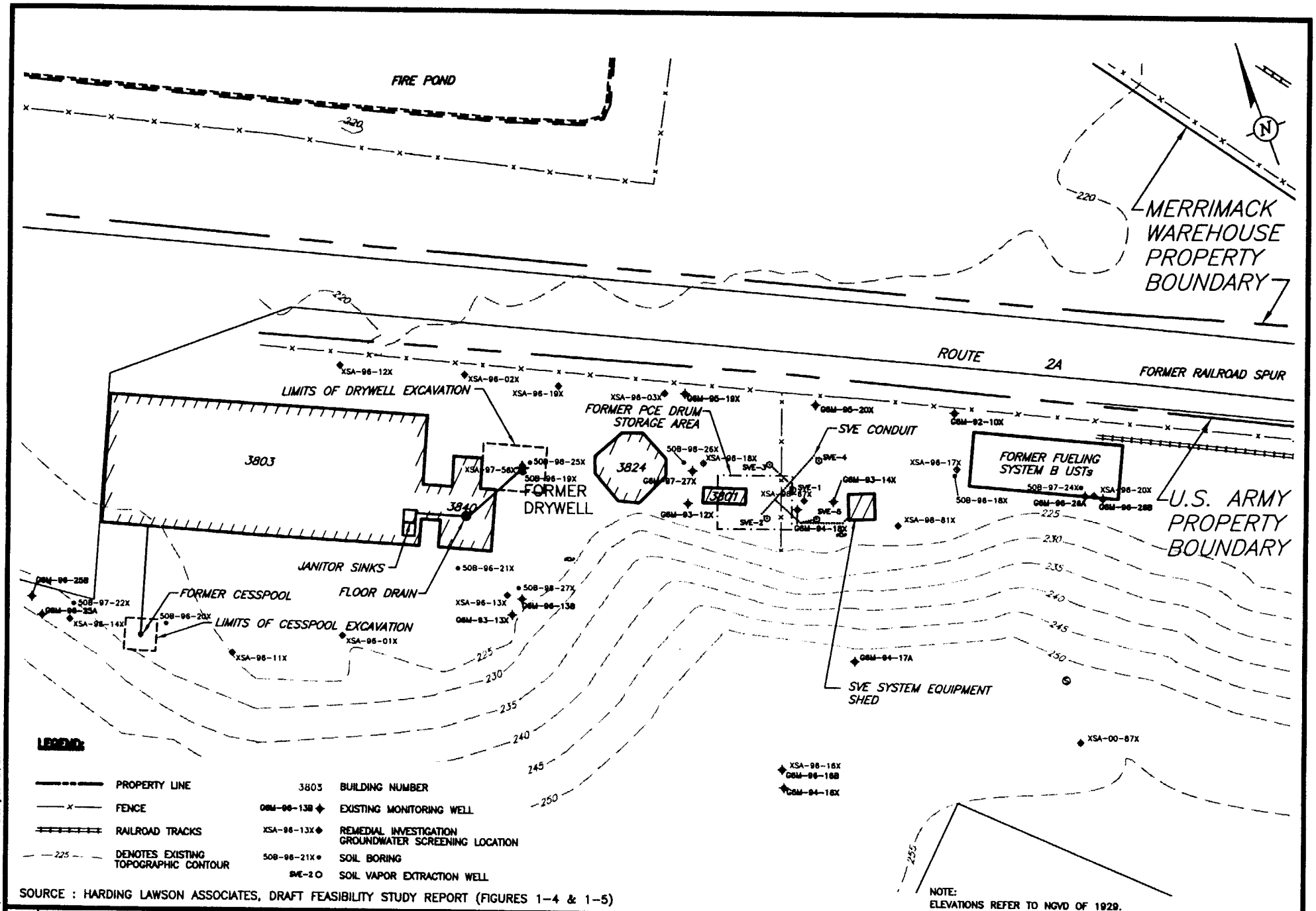
ARCADIS

SITE LOCATION

FIGURE NUMBER 1

PROJECT MANAGER: C. CASTELLUCCIO | CHECKED BY: J. HORST | DRAWN BY: R. BOWMAN | DATE DRAWN: 02/17/03 | DRAWING NUMBER: | PROJECT NUMBER: MA000664.0002

RBOWMAN, 01/20/2004, 11:34:25 | FILE: FIG1.DWG



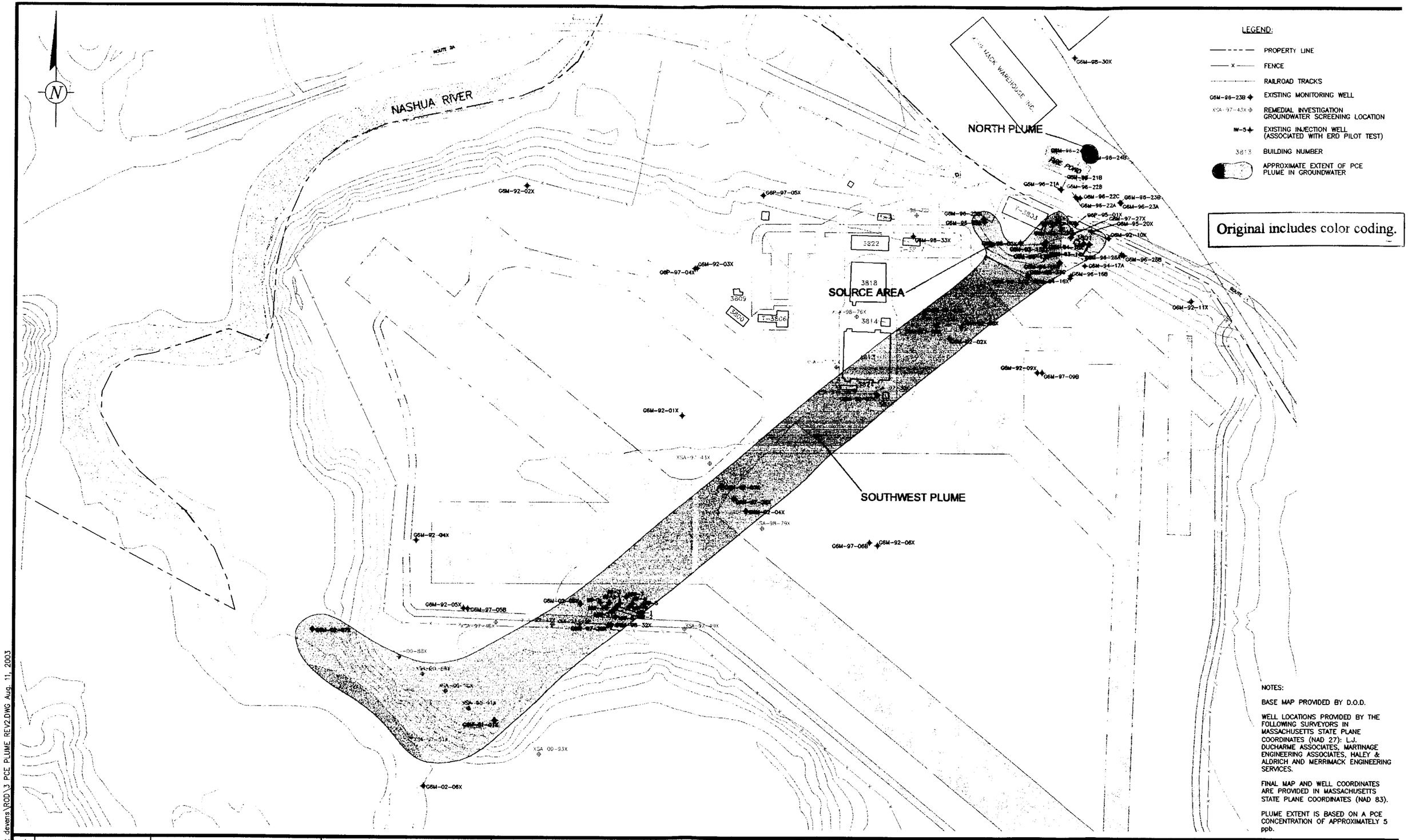
SOURCE : HARDING LAWSON ASSOCIATES, DRAFT FEASIBILITY STUDY REPORT (FIGURES 1-4 & 1-5)

0 60
SCALE IN FEET

ARCADIS
175 Cabot Street, Suite 400
Lowell, Massachusetts 01854
Tel: 978/937-9999 Fax: 978/937-7555

DRAWN M. WASILEWSKI	DATE 2/08/02	PROJECT MANAGER C. CASTELLUCCIO	DEPARTMENT MANAGER A. HANNUM
SOURCE AREA		LEAD DESIGN PROF. M. HANSEN	CHECKED J. HORST
AOC 50 DEVENS, MASSACHUSETTS		PROJECT NUMBER MA000664.0001	DRAWING NUMBER 2

C:\DRAFTING\DWG\Vert devens\ROD\2 AOC-50 SOURCE AREA.dwg Jan. 21, 2004



NOTES:

BASE MAP PROVIDED BY D.O.D.

WELL LOCATIONS PROVIDED BY THE FOLLOWING SURVEYORS IN MASSACHUSETTS STATE PLANE COORDINATES (NAD 27): L.J. DUCHARME ASSOCIATES, MARTINAGE ENGINEERING ASSOCIATES, HALEY & ALDRICH AND MERRIMACK ENGINEERING SERVICES.

FINAL MAP AND WELL COORDINATES ARE PROVIDED IN MASSACHUSETTS STATE PLANE COORDINATES (NAD 83).

PLUME EXTENT IS BASED ON A PCE CONCENTRATION OF APPROXIMATELY 5 ppb.

0 300
SCALE IN FEET

NO.	DATE	REVISION DESCRIPTION	BY / CKD

ARCADIS
175 Cabot Street, Suite 400
Lowell, Massachusetts 01854
Tel: 978/937-9999 Fax: 978/937-7555

AOC 50

DEVENS, MASSACHUSETTS

DRAWN	DATE	PROJECT MANAGER	DEPARTMENT MANAGER
R.BOWMAN	8/11/03	C. CASTELLUCCIO	P. MILIONIS
		LEAD DESIGN PROF. M. HANSEN	CHECKED J. HORST

LIMITS OF THE PLUME REQUIRING INSTITUTIONAL CONTROLS

PROJECT NUMBER	DRAWING NUMBER
MA000664.0001	3

Administrative Record Index

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COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Central Regional Office, 627 Main Street, Worcester, MA 01608

MITT ROMNEY
Governor

KERRY HEALEY
Lieutenant Governor

ELLEN ROY HERZFELDER
Secretary

ROBERT W. GOLLEDGE, Jr.
Commissioner

January 15, 2004

Mr. Benjamin F. Goff
BRAC Environmental Coordinator
30 Quebec Street, Box 100
Devens, Massachusetts 01433-5190

RE: Letter of Concurrence
Final Record of Decision
Area of Contamination 50
Devens, Massachusetts

Dear Mr. Goff:

The Massachusetts Department of Environmental Protection (MADEP) has reviewed the Final Record of Decision (ROD) proposed by the U.S. Army for Area of Contamination 50 (AOC 50). The MADEP has worked closely with both the Army and the U.S. Environmental Protection Agency to attain consensus on the ROD. The MADEP agrees with the Army's selected remedial actions as outlined in the document and concurs with the ROD.

The ROD addresses the clean up of the medium-high yield aquifer underlying most of the site. The primary Chemical of Concern (COC) targeted for clean up is tetrachloroethene (PCE) and derivatives thereof. Other volatile organic compounds (VOCs) and inorganic compounds are included in the COC list for remediation, which is presented in the ROD. One of the key components of the selected remedy for AOC 50 is Enhanced Reductive Dechlorination (ERD), a food-grade molasses solution that is injected into the aquifer. As a result of pilot testing, using this technology, dissolved arsenic has appeared. Additionally, the Army has agreed to remediate dissolved arsenic.

The selected remedy is Alternative 6, which was presented to the public in the proposed plan. The principal components of Alternative 6 are the following:

- Soil Vapor Extraction (SVE) in the Source Area;
- Enhanced reductive Dechlorination (ERD) throughout the site;
- In-Well Stripping (IWS) along the downgradient portion of the Southwest Plume;
- Chemical Oxidation in the North Plume (contingency);
- Iron injection downgradient of the last ERD transect (contingency);
- Long-term monitoring
- Institutional Controls (ICs);
- Five-year reviews

The MADEP has worked closely with the Army, the EPA and the public in the development of this remedy. The MADEP is also working with Mass Development and the Devens Enterprise Commission on institutional controls and detailed guidance for any subsequent development at AOC 50. Our concurrence with the remedial alternative is based on this involvement as well as the remedy's compliance with Applicable or Relevant and Appropriate requirements (ARARs) and it's overall performance of human health and the environment. We look forward to continuing to work with the Army and the EPA during the implementation of the selected remedy and it's future processes.

Sincerely,

Martin Suuberg
Regional Director
Central Regional Office

CC: Devens Mailing List
Robert Brown, MADEP
Carol Keating, EPA
Charles Castelluccio, ARCADIS

APPENDIX C

Responsiveness Summary

This Responsiveness Summary has been prepared to meet the requirements of Section 113(k)(2)(B)(iv) and 117(b) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), which requires response to "....significant comments, criticisms, and new data submitted in written or oral presentations" on a proposed plan for remedial action. The purpose of this Responsiveness Summary is to document the Army's responses to questions and comments expressed during the public comment period by the public, potentially responsible parties, and governmental bodies in written and oral comments regarding the Proposed Plan top Clean Up Areas of Contamination (AOC) 50 at the Devens Reserve Forces Training Area (RFTA), Devens, Massachusetts.

The Army, as part of its commitment to involve the affected communities, forms a RAB when an installation closure involves transfer of property to the community. The Fort Devens RAB was formed in February 1994 to add members of the Citizen's Advisory Committee (CAC) to the TRC. The CAC had been established previously to address Massachusetts Environmental Policy Act/Environmental Assessment issues concerning the reuse of property at Devens RFTA. The RAB consists of representatives from the Army, USEPA Region I, MADEP, local governments and citizens of the local communities. It meets monthly and provides advice to the installation and regulatory agencies on the Devens RFTA cleanup programs. Specific responsibilities include: addressing cleanup issues such as land use and cleanup goals, reviewing plans and documents, identifying proposed requirements and priorities, and conducting regular meetings that are open to the public.

On January 20, 2003, the Army issued the PP, to provide the public with an explanation of the Army's proposal for remedial action at AOC 50. The PP also described the opportunities for public participation and provided details on the upcoming public comment period and public meeting.

On January 22, 2003, the Army published a public notice announcing the PP, the date for a public information meeting, and the start and end dates of a 30-day public comment period in the Harvard Post and papers of the Nashoba Publishing Company (Groton Landmark, Harvard Hillside, Pepperell Free Press, The Public Spirit, Ayer, Shirley Oracle, and Townsend Times). The Army also made the PP available to the public at the public information repositories at the Ayer Public Library, the Hazen Memorial Library in Shirley, the Harvard Public Library, and the Lancaster Public Library, or by request from the Devens BRAC Environmental Office.

From January 23 through February 20, 2003, the Army held a 30-day public comment period to accept public comments on the Proposed Plan. On January 30, 2003, the Army held an informal public information meeting at Devens RFTA to present the Army's Proposed Plan to the public and to provide the opportunity for open discussion concerning the PP. A written request to extend the comment period for the PP from February 20, 2003 to March 7, 2003 was accepted by the BRAC office on February 20, 2003.

On February 7, 2003, the Army published a public notice announcing the Proposed Plan, the date for a public hearing in the Harvard Post and papers of the Nashoba Publishing Company (Groton Landmark, Harvard Hillside, Pepperell Free Press, The Public Spirit, Ayer, Shirley Oracle, and Townsend Times). On February 19, 2003, the Army held a Public Hearing to present the PP and accept formal verbal or written comments from the public. A transcript of this hearing, formal public comments, and the Army's response to comments are included in this Responsiveness Summary.

An overview of Remedial Alternatives Considered in the Feasibility Study including the selected remedy is in Section 10 and 12 of the ROD, respectively. The ROD also includes a section on Community Participation (Section 3.0).

Outlined below are the verbal and written comments received during the public comment period and formal Army responses to the comments received during the public comment period. A transcript of the February 19, 2003 public hearing is included as Attachment A to this Responsiveness Summary. Copies of the written comments are also included in Attachment A of this Responsiveness Summary.

The Army received verbal comments from seven people during the public hearing on February 19, 2003, and written comments from one person during the public comment period (See attachment A to this Appendix). The commenters are listed below:

Provided comments at hearing

Henry Woodle, Principal of Merrimack Warehouse, Ayer, Massachusetts
Carolyn McCreary for Laurie Nehring, past president of People of Ayer Concerned About the Environment, Ayer, Massachusetts
Carolyn McCreary, current co-president of People of Ayer Concerned About the Environment, Ayer, Massachusetts
Richard Doherty, GeoInsight, Westford, Massachusetts
Cornelius Sullivan, Ayer Board of Selectmen, Ayer, Massachusetts
Don Kochis, 26 Park Lane, Harvard, Massachusetts
Kathleen Bourassa, Resident of Shirley, Massachusetts

Provided written comments

Anita Hegarty, Ayer Town Administrator, Ayer, Massachusetts

Public Hearing Notes
February 19, 2003
Devens Conference Center
7:00 - 9:30 pm

Mr. Henry Woodle, Principal, Merrimack Valley Warehouse

Comment:

My property is impacted by AOC 50. As a citizen and taxpayer I am very concerned with the pollution. I would like to see the cleanup done. I have reservations and real concerns about institutional controls. The information given is vague. This could impact plans I have going forward this Spring. Why should I have deed restrictions? What are my means of compensation? We need a speedy cleanup; I will do my part. I have not had adequate explanation of the mechanism for the cleanup.

Response: We appreciate your comments and concerns and the Army and regulatory community is also concerned about the AOC 50 plume. Remedial Alternative 6 was chosen as the remedy for the Site because it incorporates several different remedial technologies for different areas where the impacts are present. The Army believes that the remedial alternative that has been selected for the site has the best possibility of remediating the site in an expeditious manner. Furthermore, the cleanup time for your portion of the plume would be much shorter than the cleanup time for the entire plume (most likely five to ten years). January 2004 analytical data indicates that only one well on the Merrimack Warehouse property (G6M-96-24B) exceeds the EPA Primary Drinking Water Standard (e.g. Maximum Contaminant Level (MCL) of 5 micrograms per liter (μg/L)). The level detected was 11 μg/L. This concentration is consistent with the downward trend in concentrations observed since 1999. Institutional controls (ICs) are often an important part of a remedy and are established to ensure that the remedy is protective of human health and the environment and are commonly included as part of groundwater remediation projects throughout the country. The US Army cannot impose deed restrictions or institutional controls on private property. The Army will negotiate necessary access and land-use controls to prevent exposure to groundwater and to protect the remedy. The Army will implement, monitor, report on, and enforce these restrictions. The risk assessment indicates acceptable human risk for commercial/industrial use of groundwater associated with the North Plume. However, utilization of this groundwater would require compliance with applicable state and federal regulations. We ask that you work with the Army to implement institutional controls that will allow for a more rapid cleanup of AOC 50 and assure that the remedy will be protective of human health under potential future use scenarios. In addition, current zoning restricts the property to non-residential uses.

Compensation for impacts to your property from AOC 50 should be addressed through the Army. The Devens BRAC office can provide you with the proper authorities to contact for discussions related to this issue.

Discussions regarding the mechanisms for cleanup are in the Proposed Plan and the Feasibility Study, which have been mailed to you and have also been discussed at RAB meetings and public meetings/hearings.

Ms. Laurie S. Nehring, Past President of PACE

Comment 1:

The purpose of this Proposed Plan is to inform the general public of the work plans for the cleaning up of contamination found at Moore Army Airfield so that they (the general public) can offer useful comments to the Army. This Proposed Plan needed to condense volumes of technical data and years of site history into a few pages. While the job is commendable, I fear that only those with high technical backgrounds and/or those who have been following this project for some time will be able to comprehend it. The extensive use of acronyms should have been avoided. The glossary in the back was helpful, but I did not see it for some time. It took me well over 3 hours to get through this Plan entirely, and be sure I understood it. If minimal comments are received on this plan from the Public, the Army should not assume public approval, but rather should consider that the public is baffled.

Response:

The format that was selected for the Proposed Plan was previously used for other sites at Fort Devens and is structured to be more useful and understandable to the general public. We understand, however, that the data and concepts may be difficult to comprehend which is one of the reasons that the Army sponsors regular RAB meetings and there is a public comment period associated with the Proposed Plan. As part of the public comment period associated with the Proposed Plan for AOC 50, the Army held a public information meeting and a Public Hearing to allow the public to better understand these concepts. In addition, the public comment period was extended to allow the general public more review and comment time. We sincerely hope that the public is not baffled given the public involvement program that the Army has established for Fort Devens.

Comment 2:

In selecting a remedy, I strongly prefer the technologies that physically remove the PCE from all areas where this is feasible to do so. Please use the Soil Vapor Extraction to its fullest extent at the source area until the soil vapor containing contaminants is fully extracted. Should any new removal techniques evolve during 25+ years of remediation, please consider those. A ROD amendment may be necessary.

Response:

The Soil Vapor Extraction (SVE) system is an important part of the remedy and will be used to the fullest extent practical to reduce remaining contaminants in the vadose zone in the Source Area. To that end, a predesign investigation program has been developed to further investigate the application of SVE in the Source Area. The remedial system will be evaluated during 5-year review periods and new technologies will be considered as part of that review.

Comment 3:
I am concerned about the dependency of the Enhanced Reductive Dechlorination (ERD) in-situ treatment system, and the complexities of this site. I believe Chemical Oxidation should be re-examined for estimated restoration time and for cost (Alternative 8).

The ERD will convert the contaminant PCE eventually into harmless by-products through a degradation process. ERD technology uses microbiological activities to break down PCE, which has four chlorines, into trichloroethene (TCE) which has three, and then DCE (dichloroethylene), which has two chlorines, and finally to one (vinyl chloride). Eventually ethylene is formed, a chlorine free product which is relatively harmless. I fully support cost saving innovative technologies, as long as they are equally effective. However, this is not as straight - forward as it might appear, in comparison to other sites.

Here's why:

- The ERD technology works by creating anaerobic conditions. Unfortunately, the anaerobic condition that is ideal for the breakdown of chlorinated solvents also is ideal for mobilizing arsenic into groundwater - a serious problem encountered in this region. Pilot tests at AOC 50 have shown arsenic is being mobilized into groundwater by the ERD. Then a second (unproven at this site) treatment system to deal with the arsenic needs to be studied, tested and incorporated to solve the first problem. Does it make economic and technical sense to solve one problem by creating another?

- The daughter products of PCE during degradation (TCE, DCE, Vinyl Chloride) can be equally or even more toxic than the PCE is. Vinyl chloride is particularly of concern. Why take such risks?

- If the BRAC office should lose funding for environmental remediation (perhaps, country wide), and this cleanup effort is halted in the middle, we may be left in a much worse situation than we are now.

I believe Alternative 8, which incorporates Chemical Oxidation, may be a better technology for this site, and may be more cost effective once all costs are fully considered.

Response:

Because of the complexities of the site, a remedial approach that incorporates multiple technologies including ERD is recommended for the site. In addition to the ERD technology, In-Well Stripping (IWS), a well-proven physical mass removal technology that is effective in removing PCE, TCE, DCE, and vinyl chloride (VC) is proposed to reduce volatile organic compound (VOC) concentrations at the downgradient end of the plume. In addition, the IWS will aerate the groundwater upgradient of the Nashua River, and eliminate arsenic concentrations should they persist beyond the in-situ reactive zone (IRZ) created by the ERD. The inorganics contingency to be employed at the site, if necessary to control arsenic migration includes the potential addition of iron or other geochemical adjustments that have been used to treat arsenic in the water treatment industry for decades. In addition, after the ERD remedy is completed, if warranted based on evaluation of monitoring data, the re-precipitation of inorganics will be expedited through manipulation of aquifer chemistry or application of more effective treatment technologies along the length of the plume utilizing existing ERD wells as transects are phased out.

The daughter products of PCE may be more toxic than PCE; however, we have only seen the presence of low concentrations of vinyl chloride during the extended testing of ERD at the site. The concept of ERD is that the process is driven through end products, which are less harmful than PCE (i.e. ethane, ethene and carbon dioxide). The Institutional Controls (ICs) that will remain in effect during the remedy will also be protective of human health and the environment to eliminate risks due to daughter products, should they persist.

The concept of the guaranteed fixed price remediation contract is to insure available funds to cover unexpected conditions. In awarding the contract, the Army fully funded the remediation effort as described in the Scope of Work for AOC 50. Additional funds, if needed, will be provided by an insurance policy as part of the fixed price remediation contract.

The remedial alternative that included chemical oxidation was not selected due to excessive cost without added remedial benefit. Chemical oxidation is a proven technology, but is generally considered to be best suited for use in limited areas containing very high concentrations of VOCs when conditions are conducive to its success. However, with hydrogeologic conditions that are present (i.e. tighter soils in the Source Area, relatively thick zone of impacted aquifer, and only moderately high levels of VOCs), the cost to implement this technology are excessive. In addition, the feasibility of implementing chemical oxidation in a safe manner (due to the serious health & safety considerations of transporting and handling the strong oxidizing chemicals as opposed to food-grade reagents such as molasses for the ERD) further support implementation of the selected remedial approach (Remedial Alternative 6). Finally, the use of in-situ chemical oxidation has been reported to cause the mobilization of other dissolved inorganic species that may be present in the aquifer matrix including chromium and nickel. Therefore, the incomplete treatment of the groundwater at AOC 50 using this technique could also result.

Comment 4:

There is no discussion of the remediation or long term monitoring of jet fuel spills that had created plumes that contained benzene, ethylene dibromide, toluene, xylenes. While this problem is much smaller in comparison to the PCE, if the fuel spills were the only problem, we would be following it closely. How will the fuel spills be fully remediated and monitored, long term?

Response:

The petroleum releases that occurred at AOC 50 were last monitored during the groundwater sampling event conducted in October 2001. The analytical data indicated that petroleum-related components were not detected at concentrations above the laboratory detection limits or were at concentrations below their respective MCLs. These components will be monitored periodically until such time as the USEPA agrees that petroleum components are no longer constituents of concern at AOC 50.

Comment 5:

Under the Ecological Risk Assessment section (page 5), there is no discussion of any potential ecological impacts on wetlands or wildlife near the Nashua River's edge. Are there wetlands currently impacted on either side of the river? What about future impacts, as the plume expands, perhaps to the other side of the river? There has been at least one known instance where PCE was found on the Shirley side of the River. Both sides of the River's edge should be monitored over time. The US Fish & Wildlife Service was granted a large portion of this land for their jurisdiction - all sensitive environments need to be monitored and protected.

Response:

In the Fall of 2002, the USEPA conducted sampling in the wetlands southeast of the PCE plume. The results of the sampling indicated that there were no VOCs detected in this area that were related to AOC 50. The flow and transport model prepared by ARCADIS in the Final Feasibility Study (FS) as well as topographic and hydrogeologic principals indicate that the wetland areas would not be impacted by the PCE plume. In addition, the proposed remedial alternative is intended to prevent any potential for expansion of the PCE plume in the future.

However, as part of their commitment to the surrounding communities, the Army performed a site reconnaissance and a survey of monitoring wells on the Shirley side of the Nashua River across from the PCE plume to determine the usefulness of monitoring wells in this area. A monitoring well (XSA-00-85X) was located and deemed usable, and was sampled for VOCs on July 14, 2003. VOCs were not detected in the groundwater in this well.

Finally, as outlined in the Proposed Plan, additional monitoring wells will be installed downgradient of the proposed location of the IWS system on the north side of the Nashua River. These wells will be utilized to monitor constituents of concern before they enter the River to confirm the conclusions outlined above.

Comment 6:

The discussion of Institutional Controls (page 10) is not acceptable for private properties in Ayer. The generic statements used here appear to be identical to the language used at other contaminated sites located entirely on Devens. This language cannot be applied to the privately owned properties in Ayer, which the Army has unfortunately contaminated. Direct financial loss to property owners will result from forced deed restrictions, which become a permanent history of the property and therefore a permanent stigma. The Army also suggests Ayer make zoning changes. Zoning changes in Ayer are very controversial. This will require the passage at an Annual Town Meeting, with no guaranteed outcome. Either way, there are direct enforcement costs the town of Ayer is being pressured by the Army to accept.

In comparison, if the town of Ayer had inadvertently contaminated an aquifer resource with PCE, that, say traveled 1/2 mile into the township of Harvard or Shirley, I doubt the residents of Harvard or Shirley would be welcoming to forced Institutional Controls or Zoning changes within their town to accommodate our error, and I doubt there would be a legal way for Ayer to do so. Ayer would be required by the State to fully restore the aquifer, particularly if it was located in a high yield aquifer. End of story.

Private land owners need to be compensated fairly for the real losses in the value of their land. Clearly, when potential buyers have options to purchase different properties - their attorney's will advise them to stay clear of land that has a history of contamination, unless the price is way below market value.

This problem must be worked out, in writing, prior to the final ROD, with more public input. It sets a critical precedent.

Response:

The implementation of institutional controls at the site is for the protection of the public and owners of the affected properties and are not meant to cause a permanent stigma. Please review Section 12.1.1 of the ROD for a summary of the proposed ICs. The Army will negotiate necessary access and land use control measures with private property owners. In the case of AOC 50, no zoning changes would be necessary to maintain a level of no significant risk. The USEPA has indicated that the ROD will not be signed until they receive assurance that the Army will implement, monitor, report on, and enforce acceptable ICs at the Site so as to be protective of human health and the environment.

Comment 7:

The Contingency Plans need to state exactly when a contingency remedy will be triggered - with no possibility for different interpretations in the future when other people may be involved. The ROD should state exactly what technical criteria would trigger it. The discussion of "two consecutive sampling events" is vague and arbitrary. EPA and DEP should have strong input on the specifics of this decision. The Public should be involved at every opportunity.

Response:

The trigger for the solubilized inorganics contingency plan will be presented in the Remedial Design and will be monitored in the Sentinel Wells located upgradient of the contingency area. The sampling frequency is expected to be quarterly. Geochemical adjustments will be performed on an as needed basis to maintain the necessary aquifer conditions to facilitate the reprecipitation of solubilized inorganics, if needed. Additional details will be determined during the Remedial Design phase. The EPA and DEP will have strong input into the specifics of this decision and the public will also be involved through RAB meetings.

Comment 8:

The timing of the Five Year Site Review should be clearly stated in the final ROD with a specific month and year, so that there can be no backsliding or mis-interpretations of when these important reviews will occur, thus triggering the Contingency Plans, if they are needed.

Response:

It is anticipated that the timing for the five-year review at AOC 50 will coincide with the next five-year review scheduled in 2005; however AOC 50 may be evaluated on a schedule commensurate with the full remedy implementation and every 5 years thereafter. It should be noted that the BCT will be receiving more frequent updates on the progress of the remedy to monitor its performance. In addition, periodic updates on the performance of the remedy will be provided to the public at RAB meetings.

Carolyn McCreary, current Co-President for PACE

Comment:

Under the proposed remedy, the ground water at AOC 50 will not reach drinking water standards for 27 years. Ayer residents and industries have been under water restrictions for several years because of insufficient water supplies. The town has conducted several studies to find additional clean water supplies. One of the potential water sources is in the AOC 50 area, but investigations have avoided this area because of the known contaminants. The only source in town for additional water is the Grove Pond aquifer, but the known contaminants in this area cause great reservations about drilling additional wells there. The ground water contains high levels of arsenic, manganese and iron and the chemicals zinc and mercury and other heavy metals are found in the surface water and surrounding land.

The town of Ayer has a long history of supporting food and beverage processing industries that require an abundant clean water supply. These industries moved to town long ago partly because of our water supplies. Cains Foods ships its products to millions of customers throughout the United States. Nasoya produces over 50% of the tofu in the country and caters to customers who are especially concerned about the quality of the food they eat. EPIC and CPF bottle Pepsi products and Aquafina with water from Ayer aquifers. These companies have all been good

neighbors and integral parts of our town. They provide jobs for our residents and grant us needed tax revenues. Some of these neighbors have already been impacted by our inability to provide them with the water they need. Nasoya has placed on hold its plans for expansion because it cannot get additional water. More of that water would be available if the aquifer at AOC 50 were clean.

As part of the compensation for the destruction at AOC 50, the Army should supply the town with additional clean water supplies from the Devens property. The McPherson Well is a candidate because it is very close to the town water main. However, the fact that it is down gradient from the Shepley's Hill landfill concerns us, and we would like to investigate other possibilities at Devens.

Response:

The Army is responsible for the cleanup at AOC 50 and as such has committed the resources and personnel necessary to expedite this process. The groundwater contamination at AOC 50 cannot be solved in the short term due to the extent of the problem and must remain protective of human health and the environment. We understand and appreciate your concern regarding additional water supplies for the Town of Ayer and we realize that water restrictions have become a part of our lives throughout Massachusetts. The Army will evaluate Devens property to determine if there is an additional source of clean water that may be used by the Town.

Richard Doherty, PE, LSP, GeoInsights

Comment 1:

We strongly believe that future use of the contaminated portions of the Moore Army Airfield must be controlled. It is important to note that the estimated cleanup time for the selected alternative is 27 years. It is also important to note how difficult it is to ever achieve drinking water standards in contaminated aquifers. We believe it is essential to recognize that the cleanup time is only an estimate, and, more importantly, that there can be no assurance that the selected remedy will achieve the cleanup goals.

Therefore, it is prudent to plan for the possibility that additional steps may be needed in the future to complete the cleanup. Whether or not additional cleanup steps will be needed is something that will not be known for many years. It is possible that new and better cleanup technologies may be available by that time. To plan for the possibility that further cleanup may be needed, and to allow for the use of cleanup technologies that may be developed in the future, we believe it is essential to intelligently control the future use of the area overlying the contaminated ground water. We wish to avoid a situation where additional treatment is needed in a particular area, and the treatment cannot be performed because of the presence of new buildings or other structures.

Although some might say it is premature at this stage to raise this issue, we believe otherwise. As written, the Proposed Plan and Feasibility Study do not touch on this issue. We recommend that the selected remedy include a restriction on the construction of permanent buildings in all areas

that overlie groundwater exceeding the cleanup standards. The restrictions could be gradually lifted in the future, as areas of the Airfield come into compliance with the cleanup goals. This approach would not restrict development over the majority of the Airfield, just those areas that overlie the contamination. We encourage the Army to adopt this recommendation in light of the complexity involved in the cleanup of this site.

Response:

All parties are endeavoring to limit restrictions while being protective of human health and the environment. One of the other benefits of the proposed remedial alternative is that it provides a great deal of flexibility, due to its in-situ and safe nature as to provide the means to work in and around permanent structures that might otherwise limit use of the land. CERCLA has the flexibility to review and implement other possible future remedial alternatives should the proposed alternative prove to be ineffective.

Comment 2:

The selected remedy involves the injection of a molasses solution into the ground. The chemistry involved suggests that this measure could liberate arsenic from bedrock, thereby introducing it into the groundwater that flows to the Nashua River. The pilot test verified that the liberation of arsenic was occurring. The selected remedy addresses this concern through a contingency remedy that involves the addition of an iron source. We applaud the Army for recognizing this issue and providing a contingency remedy in the Proposed Plan. However, we are concerned with the events or series of events that would need to happen in order to trigger the contingency remedy.

It is our strong recommendation that the trigger should be set conservatively, so that the remedy is implemented in time for it to be effective. If the remedy is delayed until it is conclusively shown that a problem exists, the remedy may not be implemented in time to solve the problem.

The Proposed Plan suggests that the remedy will be triggered when dissolved arsenic exceeds the drinking water standard of 10 parts per billion, and when dissolved iron concentrations are less than 8 times the arsenic concentration. Because both conditions must be met, it is possible that dissolved arsenic concentrations can exceed the cleanup goal without any action being taken. Further, these conditions must occur during two consecutive sampling events. The Proposed Plan does not indicate how much time can pass between these sampling events. If sampling is performed twice per year, and allowing for the Army's laboratory turnaround and data validation, an unacceptable condition could conceivably exist for a full year before the need for a remedy is triggered. In addition, the Army intends that the trigger only apply to four "sentinel wells" located close to the river. Therefore, the Army would not be obligated to take action based on results at any other wells, regardless of how severe the conditions become.

In our opinion, the trigger for the contingency remedy needs to be re-evaluated. The trigger should not allow unacceptable conditions to persist until the next scheduled sampling round. If additional samples are required for verification, they should be obtained within four weeks of the first samples. The trigger should be equally applied to other wells that are outside the "reactive

zones" so that arsenic concentrations are not allowed to increase to unacceptable levels in upgradient portions of the site. The trigger should specify a maximum time that may elapse between the detection of the problem and the implementation of the remedy, and specify what penalties would result from exceeding the maximum time. And finally, the Proposed Plan should specify that the trigger would remain in place even after the contingency remedy is implemented, so that if the contingency remedy is not effective in a timely manner, a different approach to address the arsenic problem would be required.

We anticipate that the Army's response will be that our comments are premature, and that the details of the trigger will be worked out during later stages of the project. We, however, believe that these details are important, and need to be clearly specified in the Record of Decision, with the opportunity for meaningful public input. We therefore are making our concerns known at this time, and we are requesting the opportunity for meaningful involvement in these important decisions, at whatever time they are made.

Response:

The solubilized inorganics contingency remedy will include adjustments to the chemistry of the groundwater approaching the IWS system in the event that it is deemed necessary to facilitate the re-precipitation of inorganics in the naturally aerobic zones downgradient of the furthest ERD application. Under the natural aerobic conditions present at the Site, inorganics such as arsenic are strongly adsorbed to the soil; however, the proposed IWS portion of the remedy will provide an added layer of protection regarding the immobilization of inorganics.

The contingency trigger will be discussed further in the Remedial Design document. As stated in an earlier response, the exact sampling frequency and confirmatory event for the trigger will also be determined during the Remedial Design phase since it would be based on distance (travel time) between Sentinel Wells and the contingency wells. The EPA and DEP will have strong input into the specifics of this decision and the public will be involved through RAB meetings.

Comment 3:

The Army recognizes the need for a trigger for addressing arsenic. We believe that a trigger is also needed for additional action in the event that the selected molasses remedy is not effective in reducing PCE concentrations in a timely manner. The trigger should include clear milestones that must be reached at 5-year intervals. If the milestones are not reached, then additional remedies would be required. To avoid future misinterpretation, the 5-year requirements should be clearly stated in the ROD, with specific milestones and the exact month and year in which they must be attained.

Response:

The selected remedy is a combination of technologies that collectively will be used to restore the groundwater quality at AOC 50. The ERD technology is a part of the selected remedy. Based on the pilot test that was successfully conducted at the Site, the Army is confident that the ERD technology will be effective in the treatment of PCE; however, the

use of other technologies presented in the Feasibility Study are available to the Army for use at the Site with a modification to the ROD. Since the hydrogeologic setting has a major influence on the rate of PCE reduction, it is difficult to set 5-year goals, since different parts of the aquifer may react at different rates. Instead periodic reviews of the Site data and the 5-year USEPA reviews, as called for by CERCLA, will be used to evaluate the effectiveness of the system and modifications will be made, if necessary, to effectively expedite cleanup.

Comment 4:

Additional permanent monitoring wells are needed throughout the plume to verify the progress of the cleanup. In particular, additional wells are needed in the vicinity of Building 3813, in the area near G6M-02-13X, and downgradient of the circulation wells. In our opinion, the current network of permanent wells is not sufficient to monitor the progress of the cleanup.

Response:

The Army agrees and recognizes that additional monitoring wells are needed for predesign purposes and for long term monitoring. Additional permanent monitoring wells have already been installed throughout the plume. As part of a predesign investigation the Army installed six new wells in the Source Area, one mid-plume well in the area of Building 3813, and three Sentinel Wells downgradient of the ERD area. Monitoring wells will also be installed in the area of the IWS system as well as other areas along the Southwest Plume to provide better coverage for long-term monitoring.

Comment 5:

We do not believe that chemical oxidation has been given an adequate evaluation in the feasibility study. Alternative 8 is referred to as a "chemical oxidation" alternative, but in reality it is an "in-well stripping" alternative that includes chemical oxidation in only a small portion of the site. It is worth noting that Arcadis' model indicates that the area where chemical oxidation is used will reach the cleanup goals within 5 to 10 years. Despite this clear advantage in terms of cleanup time, the feasibility study does not include an alternative that uses chemical oxidation across the entire plume.

According to the feasibility study, chemical oxidation is not recommended for the entire plume because it would require many injection points, it could possibly decrease permeability, and it could increase the concentration of an inorganic species of concern, which in this case is manganese. However, each of these issues also holds true for molasses injection - it requires many injection points, it could decrease permeability, and it increases the concentration of an inorganic - in this case arsenic. We agree that the chemical oxidant is more expensive on a per-pound basis than molasses. However, chemical oxidation offers the potential for a significantly faster cleanup, which reduces overall costs. The feasibility study does not include an analysis of how much could be saved by performing a roughly 10-year-long cleanup with chemical oxidation used across the entire plume.

Response:

As outlined above in the response to Ms. Nehring's third comment, chemical oxidation is a proven technology, but is widely considered to be best suited for use in limited areas containing very high VOC concentrations. The Army did not include a remedial alternative consisting of chemical oxidation as a stand-alone method for plume-wide treatment, the Army did consider this approach during the evaluation of potential remedial options for the Site. Given the large area of impacted groundwater at AOC 50 (3,000-foot long plume), the cost to implement chemical oxidation in a stand-alone manner would be excessive (fifty to one hundred million dollars). Therefore, the cost savings due to shorter completion of the remedy would far outweigh the capital investment required. The health & safety considerations and potential for inorganics mobilization (discussed above) further support the selected remedial approach.

Comment 6:

It is our opinion that chemical oxidation offers significant advantages at the Moore Army Airfield. Data have shown that the ground water at the site is naturally oxidized, which makes oxidation inherently easier, and reduction using molasses inherently more difficult. Further, chemical oxidation produces carbon dioxide and water, while reduction using molasses yields trichloroethylene, a known carcinogen, followed by dichloroethylene, an inhalation hazard, followed by vinyl chloride, a carcinogen more toxic than those which precede it. Only when vinyl chloride is degraded do we reach a relatively non-toxic product. For these reasons, we believe that chemical oxidation is a preferable remedy, and due to its rapid action, it may ultimately be a less expensive remedy. Even if the cost is higher, the benefit of more timely restoration of the high-yield aquifer would be of great value to the community.

Response:

As noted in response to Ms. Nehring's Comment 3 above, chemical oxidation is cost prohibitive, has other limitations, and is more difficult to implement safely at a scale of this size. Although aquifer conditions are naturally oxidized, the ERD pilot test has shown that overcoming the naturally oxidizing conditions can be readily accomplished. To date, vinyl chloride has only been detected at low concentrations at the Site. All things considered, the selected remedy, including ERD, will be an effective remedy for AOC 50.

Connie Sullivan, Board of Selectmen, Town of Ayer

Comment 1:

The Board is preparing a draft letter as part of the ROD. We will request that the Army take written comments beyond 30 days. I will be in touch with the Board of Selectmen. We will contact the Army for an extension.

Response:

The Town of Ayer requested an extension and the Army extended the Public Comment period from February 20 to March 7, 2003.

Comment 2:

Institutional Controls are a problem for Board members. There is a stigma on a property even after property is cleaned. Title searches go back 50 years. It would be a problem if Mr. Woodle's property showed Institutional Controls. The Town will likely not be cooperative at placing controls. If you are looking for Ayer for cooperation regarding ICs, I don't think this will happen. Even if they could cooperate, their hands may be tied by private owners not cooperating beyond Mr. Woodle's property.

Response:

The Army realizes that the Town of Ayer is concerned about the use of ICs in Ayer; however, they are a necessary part of the remedy to restrict use and protect human health and the environment. The Army will be negotiating agreements with the affected property owners to insure that ICs are in place. The selected remedy also relies upon existing zoning restrictions to effectively restrict residential land use. The use of groundwater in proximity to the North Plume for commercial/industrial purposes is not restricted under the current risk assessment, but must be accomplished in compliance with appropriate state and federal regulations.

Don Kochis, Resident of Shirley

Comment :

I've worked for a company located in Ayer since 1973. My concern is what recourse would an individual have and to whom, if it is determined a disease and or illness occurred due to PCE?

Response:

This is not the forum for this question. If you feel that it would be helpful, please contact the local Board of Health.

Kathleen Bourassa, Resident

Comment:

My concern is the clean up time frame for remediation of 27 years. We should quicken this up any way we can. It would be a real benefit to fully delineate the area. We need to delineate the plume as heavy compounds are moving towards the river. I am concerned about a sinking plume.

We don't want to make assumptions that it is /isn't dispersing into the Nashua and my home town. A faster cleanup is preferable.

Response:

In response to your concerns, the Army is installing additional wells to fully delineate the plume and has done a literature search and well reconnaissance on the Shirley side of the Nashua River across from the AOC 50 PCE plume. Based on the findings of this work, the most useable monitoring well was sampled for volatile organic compounds including PCE. There were no VOCs detected in the groundwater from this well. It is important to note that the predominant direction of groundwater flow on both sides of the Nashua River is toward the River. Therefore, if PCE from the MAAF is detected on the Shirley side of the River, it would ultimately flow back to and discharge to the River. In addition, the bedrock elevation rises significantly as you move away from the Nashua River toward Shirley. This would further restrict the movement of groundwater and PCE toward Shirley.

Written Comments from Anita M. Hegarty, Ayer Town Administrator

Comment:

The Board of Selectmen for the Town of Ayer has been asked by the Department of Defense to consider the implementation of institutional controls as part of the Department's cleanup of the site known as AOC50. The Board understands that such controls would impact the use of property impacted by the release of contaminants from the Department's property, including soil and groundwater use. Many effective institutional controls require long term implementation and enforcement of land use restrictions such as zoning bylaws, general bylaws, local permits, and groundwater restrictions. The use of institutional controls is intended to control land uses to avoid unacceptable risks. The Department has suggested that that the Record of Decision for the cleanup of the site will include the implementation of institutional controls as part of the anticipated remediation of the site and off-site impacts.

As you are aware, some of the properties which will be impacted by the proposed institutional controls are private properties outside the jurisdiction of the Department. As described to the Town by the Department, the institutional controls would likely be implemented either by agreement with private property owners, or through changes in local zoning bylaws. The Town would not be a party to any private agreements, and enforcement of those agreements would be a matter of negotiations between the property owner and the Department. Zoning changes would, however, require action by the Town. The Town may implement changes in zoning only through compliance with a statutory process involving public hearing and a vote of Town Meeting. The Department and the Town cannot simply agree to changes in zoning. Thus, if institutional controls are dependent upon zoning changes, then implementation of such controls will be subject to the will of Town Meeting.

Response:

The statement concerning the request to the Town of Ayer from the Department of Defense (DoD) for institutional controls has not been properly characterized. The Army was awaiting guidance from the DoD relative to institutional control language for decision documents, like the Record of Decision. Subsequently the Army authorized the use of the EPA/Department of Navy Principles and Procedures for Specifying, monitoring and Enforcement of Land Use controls and other Post-ROD Actions. Based on these Principals and Procedures, the Army intends to negotiate agreements with affected property owners to ensure protection of human health and the environment. In addition, after discussion with the BCT, the Army has concluded that the use of existing Town zoning also provides a layer of protection. The use of groundwater in proximity to the North Plume for commercial/industrial purposes is not restricted under the current risk assessment, but must be accomplished in compliance with applicable local, state and federal regulations.

The selection of any remedial alternative at AOC 50 would require the implementation of institutional controls to limit the use of groundwater in impacted areas. These institutional controls would be required to remain in place until it is determined that the groundwater is suitable for use by the property owner. There is currently only one privately owned property that would require an institutional control for AOC 50 (Merrimack Valley Warehouse). The Army will negotiate with the property owner for access and land use control measures and will be responsible for implementing, monitoring, reporting on, and enforcing the land use control measures. The selected remedy also relies upon existing zoning restrictions. Therefore the Army will not be requesting a change to the local zoning bylaws in the Town of Ayer. Furthermore, the Town would not need to be a party to, or enforce any agreements between the Army and private property owners, in this case the Merrimack Valley Warehouse property.

Comment 2:

The Town may be asked to undertake enforcement of institutional controls upon the impacted properties. This enforcement apparently will require the Town to exercise its police powers to regulate land use in the interest not only of protecting public health and safety, but also in the interest of assisting the Department in achieving a cost effective site cleanup. The Town is, of course, concerned that the enforcement of institutional controls would constitute an administrative burden. Institutional controls require that land uses be restricted in such a manner as to avoid impacts from the contaminants release from AOC50. The enforcement of such restrictions would require the Town to undertake inspections and take action should land uses conflict with the institutional controls. Town resources, including staffing, are already overburdened in dealing with the day-to-day issues of statutory, regulatory, and by-law enforcement. The Town, like other municipalities in Massachusetts, is experiencing financial difficulties based upon the state deficit and pending budget cuts. The Town may simply be unable to take on the additional obligation of enforcing the Department's institutional controls.

Response:

The Army will be negotiating an IC agreement with the property owners to minimize the impact on the Town. Therefore the use of police powers to regulate land use would not be likely and an additional administrative burden would not occur. In addition, Town inspections would not be necessary as the Army will be responsible for implementing, monitoring, reporting on, and enforcing ICs for AOC 50.

Comment 3:

While the Town shares the goal of the Department in achieving an effective remediation of the site, the Town is concerned that the burdens of that goal will be placed upon the Town. Given the lack of responsibility of the Town for the contamination, the Town questions the fairness of placing this burden upon the Town. The mere fact that a more cost-effective cleanup can be achieved through the implementation of institutional controls certainly is of no benefit to the Town. Therefore, the Town questions the inclusion of institutional controls in the remediation plan until such time at the Department determines the extent of those controls and the means by which the controls will be enforced. The Town also requests that the Department address the costs associated with enforcement of institutional controls, and how those costs will be allocated.

Response:

The primary form of IC for AOC 50 will be an agreement between the Army and property owners to restrict land and groundwater use. The institutional controls needed at AOC 50 are the same regardless of the remedy selected for the Site. Therefore, the costs for these controls would be the same and had little impact in the selection of the remedy for the Site. A remedy cannot be implemented at AOC 50 without institutional controls in place as required under CERCLA. The Army with concurrence of the EPA will determine when institutional controls are no longer required for the site.

Comment 4:

Until the points raised above are addressed, the Town must object to the inclusion of institutional controls in the proposed plan for AOC50 to the extent that the Town is required to implement and enforce the institutional controls. The Department must demonstrate to the Town how institutional controls can be implemented and enforced without unfairly burdening the Town and its limited resources.

It would appear that another option for enforcement of institutional controls should be explored - that being the use of a third party administrator to handle all enforcement activity rather than place this requirement on the Town of Ayer. We urge the Department to investigate this option fully. We shall expect a future opportunity to discuss this issue before any agreement is made by the Town of Ayer relative to enforcement of institutional controls.

Response:

The Town of Ayer would not have any role or responsibilities beyond normal municipal responsibilities to regulate zoning through existing regulations that are in place. There is currently one off-site property that is affected by AOC 50.

The Army will be negotiating with off-site property owner regarding ICs. The Army will meet with the Town again to further discuss the implementation of institutional controls at AOC 50.

Volume I

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PUBLIC HEARING ON :
PROPOSED CLEANUP PLAN FOR AOC 50 :
DEVENS RESERVE FORCES TRAINING AREA :
DEVENS, MASSACHUSETTS :

BEFORE MODERATOR: BEN GOFF,
BRAC ENVIRONMENTAL COORDINATOR

Held at:
Devens Conference Center
100 Sherman Avenue
Devens, MA 01432
Wednesday. February 19, 2003
7:00 p.m.

INDEX

PROCEEDINGS

(Public record portion of meeting)

MR HENRY WOODLE: My property is impacted by AOC 50. As a citizen and taxpayer I am very concerned with the pollution. I would like to see the cleanup done. I have reservations and real concerns about institutional controls. The information given is vague. This could impact plans I have going forward this Spring. Why should I have deed restrictions? What are my means of compensation? We need a speedy cleanup; I will do my part. I have not had adequate explanation of the mechanism for the cleanup.

MR GOFF: Next?

MS CAROL MCCREARY READING NOTES FROM MS LAURIE S. NEHRING: Please accept the comments below regarding the Proposed Plan for AOC 50.

Thank you for the opportunity to comment on the proposed remedy for AOC 50. This is a complex problem with no simple solutions. We are very concerned about the technologies being proposed that will need to reach the long-term clean-up goal of drinking water standards, thus returning this designated high yield aquifer to a usable water resource. The comments below are based on my understanding of the issues as presented at RAB meetings over the years, documentation received from the BRAC office, as well as technical discussions with PACE's consultant, Mr. Richard Doherty, and with other government officials.

First, a general comment: The purpose of this Proposed Plan is to inform the general public of the work plans for the cleaning up of contamination found at Moore Army Airfield so that they (the general public) can offer useful comments to the Army. This Proposed Plan

needed to condense volumes of technical data and years of site history into a few pages. While the job is commendable, I fear that only those with high technical backgrounds and/or those who have been following this project for some time will be able to comprehend it. The extensive use of acronyms should have been avoided. The glossary in the back was helpful, but I did not see it for some time. It took me well over 3 hours to get through this Plan entirely, and be sure I understood it. If minimal comments are received on this plan from the Public, the Army should not assume public approval, but rather should consider that the public is baffled.

Comment 1. In selecting a remedy, I strongly prefer the technologies that physically remove the PCE from all areas where this is feasible to do so. Please use the Soil Vapor Extraction to its fullest extent at the source area until the soil vapor containing contaminants is fully extracted. Should any new removal techniques evolve during 25+ years of remediation, please consider those. A ROD amendment may be necessary.

Comment 2. I am concerned about the dependency of the ERD in-situ treatment system, and the complexities of this site. I believe Chemical Oxidation should be re-examined for estimated restoration time and for cost (Alternative 8).

The Enhanced Reductive Dechlorination (ERD) will convert the contaminant PCE eventually into harmless by-products through a degradation process. ERD technology uses microbiological activities to break down PCB, which has four chlorines, into TCE with has three, and then DCE (dichloroethylene), which has two chlorines, and finally to one (vinyl chloride). Eventually ethylene is formed, a chlorine free product which is relatively harmless. I fully support cost saving innovative technologies, as long as they are equally effective. However, this is not as straight - forward as it might appear, in comparison to other sites.

Here's why:

- The ERD technology works by creating anaerobic conditions. Unfortunately, the anaerobic condition that is ideal for the breakdown of chlorinated solvents also is ideal for mobilizing arsenic into groundwater - a serious problem encountered in this region. Pilot tests at AOC 50 have shown arsenic is being mobilized into groundwater by the ERD. Then a second (unproven at this site) treatment system to deal with the arsenic needs to be studied, tested and incorporated to solve the first problem. Does it make economic and technical sense to solve one problem by creating another?
- The daughter products of PCE during degradation (TCE, DCE, Vinyl Chloride) can be equally or even more toxic than the PCE is. Vinyl chloride is particularly of concern. Why take such risks?
- If the BRAC office should lose funding for environmental remediation (perhaps, country wide), and this cleanup effort is halted in the middle, we may be left in a much worse situation than we are now.

I believe Alternative 8, which incorporates Chemical Oxidation, may be a better technology for this site, and may be more cost effective once all costs are fully considered.

Comment 3. There is no discussion of the remediation or long term monitoring of jet fuel spills that had created plumes that contained benzene, ethylene dibromide, toluene, xylenes. While this problem is much smaller in comparison to the PCE, if the fuel spills were the only problem, we would be following it closely. How will the fuel spills be fully remediated and monitored, long term?

Comment 4. Under the Ecological Risk Assessment section (page 5), there is no discussion of any potential ecological impacts on wetlands or wildlife near the Nashua River's edge. Are there wetlands currently impacted on either side of the river? What about

future impacts, as the plume expands, perhaps to the other side of the river? There has been at least one known instance where PCE was found on the Shirley side of the River. Both sides of the River's edge should be monitored over time. The US Fish & Wildlife Service was granted a large portion of this land for their jurisdiction - all sensitive environments need to be monitored and protected.

Comment 5. The discussion of Institutional Controls (page 10) is not acceptable for private properties in Ayer. The generic statements used here appear to be identical to the language used at other contaminated sites located entirely on Devens. This language cannot be applied to the privately owned properties in Ayer, which the Army has unfortunately contaminated. Direct financial loss to property owners will result from forced deed restrictions, which become a permanent history of the property and therefore a permanent stigma. The Army also suggests Ayer make zoning changes. Zoning changes in Ayer are very controversial. This will require the passage at an Annual Town Meeting, with no guaranteed outcome. Either way, there are direct enforcement costs the town of Ayer is being pressured by the Army to accept.

In comparison, if the town of Ayer had inadvertently contaminated an aquifer resource with PCE, that, say traveled 1/2 mile into the township of Harvard or Shirley, I doubt the residents of Harvard or Shirley would be welcoming to forced Institutional Controls or Zoning changes within their town to accommodate our error, and I doubt there would be a legal way for Ayer to do so. Ayer would be required by the State to fully restore the aquifer, particularly if it was located in a high yield aquifer. End of story.

Private land owners need to be compensated fairly for the real losses in the value of their land. Clearly, when potential buyers have options to purchase different properties - their attorney's will advise them to stay clear of land that has a history of contamination, unless

the price is way below market value.

This problem must be worked out, in writing, prior to the final ROD, with more public input. It sets a critical precedent.

1. The Contingency Plans need to state exactly when a contingency remedy will be triggered - with no possibility for different interpretations in the future when other people may be involved. The ROD should state exactly what technical criteria would trigger it. The discussion of "two consecutive sampling events" is vague and arbitrary. EPA and DEP should have strong input on the specifics of this decision. The Public should be involved at every opportunity.

2. Likewise, the timing of the Five Year Site Review should be clearly stated in the final ROD with specific a month and year, so that there can be no backsliding or mis-interpretations of when these important reviews will occur, thus triggering the Contingency Plans, if they are needed.

Thank you for your consideration.

Respectfully submitted,

Laurie S. Nehring

Past President of PACE

MR GOFF: Thank you. Next?

CAROLYN MCCREARY: I am Carolyn McCreary, current co-president for PACE, People of Ayer Concerned About the Environment. Thank you for the opportunity to comment on the AOC 50 cleanup effort.

GeoInsights and Laurie Nehring, representing PACE, are commenting on technical

details of the proposed plan for the remedy. I will focus on the cost of the contamination at AOC 50 to the town of Ayer, its industries and residents. Under the proposed remedy, the ground water at AOC 50 will not reach drinking water standards for 27 years. Ayer residents and industries have been under water restrictions for several years because of insufficient water supplies. The town has conducted several studies to find additional clean water supplies. One of the potential water sources is in the AOC 50 area, but investigations have avoided this area because of the known contaminants. The only source in town for additional water is the Grove Pond aquifer, but the known contaminants in this area cause great reservations about drilling additional wells there. The ground water contains high levels of arsenic, manganese and iron and the chemicals zinc and mercury and other heavy metals are found in the surface water and surrounding land.

The town of Ayer has a long history of supporting food and beverage processing industries that require an abundant clean water supply. These industries moved to town long ago partly because of our water supplies. Cains Foods ships its products to millions of customers throughout the United States. Nasoya produces over 50% of the tofu in the country and caters to customers who are especially concerned about the quality of the food they eat. EPIC and CPF bottle Pepsi products and Aquafina with water from Ayer aquifers. These companies have all been good neighbors and integral parts of our town. They provide jobs for our residents and grant us needed tax revenues. Some of these neighbors have already been impacted by our inability to provide them with the water they need. Nasoya has placed on hold its plans for expansion because it cannot get additional water. More of that water would be available if the aquifer at AOC 50 were clean.

As part of the compensation for the destruction at AOC 50, the Army should supply the town with additional clean water supplies from the Devens property. The McPherson Well

is a candidate because it is very close to the town water main. However, the fact that it is down gradient from the Shepley's Hill landfill concerns us, and we would like to investigate other possibilities at Devens.

MR GOFF: Anyone else?

RICHARD DOHERTY, PE, LSP: My name is Richard Doherty, and I am a Professional Engineer and Licensed Site Professional with GeoInsight, Inc. of Westford, Massachusetts. GeoInsight is the technical consultant to People of Ayer Concerned about the Environment, also known as PACE.

PACE supports the cleanup of the Moore Army Airfield, and the surrounding area, and would like to see the cleanup occur as quickly and thoroughly as possible. In general, we are pleased with the progress made by the Army and their contractor in moving this project into the cleanup phase. We look forward to the implementation of the selected remedy, to seeing progress toward the full remedial goals, and to the ultimate cleanup of this important high-yield aquifer.

Our comments on the Proposed Plan are as follows:

Comment No.1: We strongly believe that future use of the contaminated portions of the Moore Army Airfield must be controlled. It is important to note that the estimated cleanup time for the selected alternative is 27 years. It is also important to note how difficult it is to ever achieve drinking water standards in contaminated aquifers. We believe it is essential to recognize that the cleanup time is only an estimate, and, more importantly, that there can be no assurance that the selected remedy will achieve the cleanup goals.

Therefore, it is prudent to plan for the possibility that additional steps may be needed in

the future to complete the cleanup. Whether or not additional cleanup steps will be needed is something that will not be known for many years. It is possible that new and better cleanup technologies may be available by that time. To plan for the possibility that further cleanup may be needed, and to allow for the use of cleanup technologies that may be developed in the future, we believe it is essential to intelligently control the future use of the area overlying the contaminated ground water. We wish to avoid a situation where additional treatment is needed in a particular area, and the treatment cannot be performed because of the presence of new buildings or other structures.

Although some might say it is premature at this stage to raise this issue, we believe otherwise. As written, the Proposed Plan and Feasibility Study do not touch on this issue. We recommend that the selected remedy include a restriction on the construction of permanent buildings in all areas that overlie groundwater exceeding the cleanup standards. The restrictions could be gradually lifted in the future, as areas of the Airfield come into compliance with the cleanup goals. This approach would not restrict development over the majority of the Airfield, just those areas that overlie the contamination. We encourage the Army to adopt this recommendation in light of the complexity involved in the cleanup of this site.

Comment No.2: The selected remedy involves the injection of a molasses solution into the ground. The chemistry involved suggests that this measure could liberate arsenic from bedrock, thereby introducing it into the groundwater that flows to the Nashua River. The pilot test verified that the liberation of arsenic was occurring. The selected remedy addresses this concern through a contingency remedy that involves the addition of an iron source. We applaud the Army for recognizing this issue and providing a contingency remedy in the Proposed Plan. However, we are concerned with the events or series of events that would

need to happen in order to trigger the contingency remedy.

It is our strong recommendation that the trigger should be set conservatively, so that the remedy is implemented in time for it to be effective. If the remedy is delayed until it is conclusively shown that a problem exists, the remedy may not be implemented in time to solve the problem.

The Proposed Plan suggests that the remedy will be triggered when dissolved arsenic exceeds the drinking water standard of 10 parts per billion, and when dissolved iron concentrations are less than 8 times the arsenic concentration. Because both conditions must be met, it is possible that dissolved arsenic concentrations can exceed the cleanup goal without any action being taken. Further, these conditions must occur during two consecutive sampling events. The Proposed Plan does not indicate how much time can pass between these sampling events. If sampling is performed twice per year, and allowing for the Army's laboratory turnaround and data validation, an unacceptable condition could conceivably exist for a full year before the need for a remedy is triggered. In addition, the Army intends that the trigger only apply to four "sentinel wells" located close to the river. Therefore, the Army would not be obligated to take action based on results at any other wells, regardless of how severe the conditions become.

In our opinion, the trigger for the contingency remedy needs to be re-evaluated. The trigger should not allow unacceptable conditions to persist until the next scheduled sampling round. If additional samples are required for verification, they should be obtained within four weeks of the first samples. The trigger should be equally applied to other wells that are outside the "reactive zones" so that arsenic concentrations are not allowed to increase to unacceptable levels in upgradient portions of the site. The trigger should specify a maximum time that may elapse between the detection of the problem and the

implementation of the remedy, and specify what penalties would result from exceeding the maximum time. And finally, the Proposed Plan should specify that the trigger would remain in place even after the contingency remedy is implemented, so that if the contingency remedy is not effective in a timely manner, a different approach to address the arsenic problem would be required.

We anticipate that the Army's response will be that our comments are premature, and that the details of the trigger will be worked out during later stages of the project. We, however, believe that these details are important, and need to be clearly specified in the Record of Decision, with the opportunity for meaningful public input. We therefore are making our concerns known at this time, and we are requesting the opportunity for meaningful involvement in these important decisions, at whatever time they are made.

Comment No.3: The Army recognizes the need for a trigger for addressing arsenic. We believe that a trigger is also needed for additional action in the event that the selected molasses remedy is not effective in reducing PCE concentrations in a timely manner. The trigger should include clear milestones that must be reached at 5-year intervals. If the milestones are not reached, then additional remedies would be required. To avoid future misinterpretation, the 5-year requirements should be clearly stated in the ROD, with specific milestones and the exact month and year in which they must be attained.

Comment No.4: Additional permanent monitoring wells are needed throughout the plume to verify the progress of the cleanup. In particular, additional wells are needed in the vicinity of Building 3813, in the area near G6M-02-13X, and downgradient of the circulation wells. In our opinion, the current network of permanent wells is not sufficient to monitor the progress of the cleanup.

Comment No.5: We do not believe that chemical oxidation has been given an adequate

evaluation in the feasibility study. Alternative 8 is referred to as a "chemical oxidation" alternative, but in reality it is an "in-well stripping" alternative that includes chemical oxidation in only a small portion of the site. It is worth noting that Arcadis' model indicates that the area where chemical oxidation is used will reach the cleanup goals within 5 to 10 years. Despite this clear advantage in terms of cleanup time, the feasibility study does not include an alternative that uses chemical oxidation across the entire plume.

According to the feasibility study, chemical oxidation is not recommended for the entire plume because it would require many injection points, it could possibly decrease permeability, and it could increase the concentration of an inorganic species of concern, which in this case is manganese. However, each of these issues also holds true for molasses injection - it requires many injection points, it could decrease permeability, and it increases the concentration of an inorganic - in this case arsenic. We agree that the chemical oxidant is more expensive on a per-pound basis than molasses. However, chemical oxidation offers the potential for a significantly faster cleanup, which reduces overall costs. The feasibility study does not include an analysis of how much could be saved by performing a roughly 10-year-long cleanup with chemical oxidation used across the entire plume.

Finally, it is our opinion that chemical oxidation offers significant advantages at the Moore Army Airfield. Data have shown that the ground water at the site is naturally oxidized, which makes oxidation inherently easier, and reduction using molasses inherently more difficult. Further, chemical oxidation produces carbon dioxide and water, while reduction using molasses yields trichloroethylene, a known carcinogen, followed by dichloroethylene, an inhalation hazard, followed by vinyl chloride, a carcinogen more toxic than those which precede it. Only when vinyl chloride is degraded do we reach a relatively non-toxic product. For these reasons, we believe that chemical oxidation is a preferable

remedy, and due to its rapid action, it may ultimately be a less expensive remedy. Even if the cost is higher, the benefit of more timely restoration of the high-yield aquifer would be of great value to the community.

We appreciate the opportunity to provide comments on this Proposed Plan, and we respectfully request that the Army give our comments careful consideration. Thank you.

MR GOFF: Next?

CONNIE SULLIVAN: There was confusion regarding where the meeting was taking place – the Commerce Center versus the Conference Center, I went to the Commerce Center because that is what I had written down from the meeting at the Town of Ayer on February 11, 2003. Residents may have been in the wrong place and may have missed this meeting. I am concerned that there is insufficient time for comments on the Proposed Plan.

The Board is preparing a draft letter as part of the ROD. We will request that the Army take written comments beyond 30 days. I will be in touch with the Board of Selectmen. We will contact Ben for an extension. Regarding water issues we depend on PACE, but are concerned with the water supply for the Town. Our findings concur with Rich and Laurie (PACE).

Institutional Controls are a problem for Board members. There is a stigma on a property even after property is cleaned. Title searches go back 50 years. It would be a problem if Mr. Woodle's property showed Institutional Controls. Town will likely not be cooperative at placing controls. If you are looking for Ayer for cooperation regarding ICs, I don't think this will happen. Even if they could cooperate their hands may be tied by private owner not cooperating beyond Mr. Woodle's property.

Institutional Controls are a further issue at Shepley Hill Landfill along West Main Street. The AOC 50 Hearing tonight is important to the Town.

Thank you

MR GOFF: Thank you. Any other comments?

DON KOCHIS: I am not a resident of Ayer. I've worked for a company located in Ayer since 1973. My concern is what recourse would an individual have and to whom, if it is determined a disease and or illness occurred due to PCE?

Thank You

MR GOFF: Anyone else?

KATHLEEN BOURASSA: I am a resident of Shirley. My concern is the clean up time frame for remediation of 27 years. We should quicken this up any way we can. It would be a real benefit to fully delineate the area. We need to delineate the Plume as heavy compounds are moving towards the river. I am concerned about a sinking Plume. We don't want to make assumptions that it is /isn't dispersing into the Nashua and my home town. A faster cleanup is preferable.

Thank You

MR GOFF: Any other comments?

CAROL KEATING: Thank you everyone for coming out tonight. The last Proposed Plan

(AOC 57) was revised to incorporate your comments and we have some things to reassess. Thank you for everyone's time, it was a huge undertaking with the feasibility study that was completed at AOC 50. If you feel you need an extension to comment on the Proposed Plan contact Ben Goff.

(Public hearing concluded at 9:27 p.m.)

Board of Selectmen

MEETING TUESDAYS AT 7:00 P.M. • UPPER TOWN HALL • 1 MAIN STREET • AYER, MASSACHUSETTS 01432

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March 4, 2003

Charles M. Castellucio
Principle Scientist
Arcadis G&M, Inc.
175 Cabot Street, Suite 400
Lowell, MA 01854

Re: Town of Ayer's Response to AOC50 Proposed Plan

Dear Mr. Castellucio,

The Board of Selectmen for the Town of Ayer has been asked by the Department of Defense to consider the implementation of institutional controls as part of the Department's cleanup of the site known as AOC50. The Board understands that such controls would impact the use of property impacted by the release of contaminants from the Department's property, including soil and groundwater use. Many effective institutional controls require long term implementation and enforcement of land use restrictions such as zoning bylaws, general bylaws, local permits, and groundwater restrictions. The use of institutional controls is intended to control land uses to avoid unacceptable risks. The Department has suggested that that the Record of Decision for the cleanup of the site will include the implementation of institutional controls as part of the anticipated remediation of the site and off-site impacts.

As you are aware, some of the properties which will be impacted by the proposed institutional controls are private properties outside the jurisdiction of the Department. As described to the Town by the Department, the institutional controls would likely be implemented either by agreement with private property owners, or through changes in local zoning bylaws. The Town would not be a party to any private agreements, and enforcement of those agreements would be a matter of negotiations between the property owner and the Department. Zoning changes would, however, require action by the Town. The Town may implement changes in zoning only through compliance with a statutory process involving public hearing and a vote of Town Meeting. The Department and the Town cannot simply agree to changes in zoning. Thus, if institutional controls are dependent upon zoning changes, then implementation of such controls will be subject to the will of Town Meeting.

The Town may be asked to undertake enforcement of institutional controls upon the impacted properties. This enforcement apparently will require the Town to exercise its police powers to regulate land use in the interest not only of protecting public health and safety, but also in the interest of assisting the Department in achieving a cost effective site cleanup. The Town is, of course, concerned that the enforcement of institutional controls would constitute an administrative burden. Institutional controls require that land uses be restricted in such a manner as to avoid impacts from the contaminants release from AOC50. The enforcement of such restrictions would require the Town to undertake inspections and take action should land uses conflict with the institutional controls. Town resources, including staffing, are already overburdened in dealing with the day-to-day issues of statutory, regulatory, and by-law enforcement. The Town, like other municipalities in Massachusetts, is experiencing financial difficulties based upon the state deficit and pending budget cuts. The Town may simply be unable to take on the additional obligation of enforcing the Department's institutional controls.

While the Town shares the goal of the Department in achieving an effective remediation of the site, the Town is concerned that the burdens of that goal will be placed upon the Town. Given the lack of responsibility of the Town for the contamination, the Town questions the fairness of placing this burden upon the Town. The mere fact that a more cost-effective cleanup can be achieved through the implementation of institutional controls certainly is of no benefit to the Town. Therefore, the Town questions the inclusion of institutional controls in the remediation plan until such time at the Department determines the extent of those controls and the means by which the controls will be enforced. The Town also requests that the Department address the costs associated with enforcement of institutional controls, and how those costs will be allocated.

Until the points raised above are addressed, the Town must object to the inclusion of institutional controls in the proposed plan for AOC50 to the extent that the Town is required to implement and enforce the institutional controls. The Department must demonstrate to the Town how institutional controls can be implemented and enforced without unfairly burdening the Town and its limited resources.

It would appear that another option for enforcement of institutional controls should be explored – that being the use of a third party administrator to handle all enforcement activity rather than place this requirement on the Town of Ayer. We urge the Department to investigate this option fully. We shall expect a future opportunity to discuss this issue before any agreement is made by the Town of Ayer relative to enforcement of institutional controls.

Very Truly Yours,

Anita M. Hegarty
Ayer Town Administrator
For the Ayer Board of Selectmen

C: Ayer Board of Selectmen
Mark Reich, Esq.
Benjamin Goff, BRAC
Carol Keating, EPA
file